AIR GUNS

BY

ELDON G. WOLFF

MILWAUKEE PUBLIC MUSEUM
PUBLICATIONS IN HISTORY 1

MILWAUKEE PUBLIC MUSEUM
PUBLICATIONS IN HISTORY

NUMBER 1

Air Guns

by

ELDON G. WOLFF

Printed by
THE NORTH AMERICAN PRESS
Milwaukee, Wis.

Engravings by
MANDEL ENGRAVING CO.
Milwaukee, Wis.

Air Guns

TABLE OF CONTENTS

	Page
Preface	1
Historical Review	3
Introduction	3
General References	4
Antiquity of the Air Gun	5
The Air Gun as an Actuality	13
Preliminary Specimen Analysis	17
The Air Gun as a Weapon	18
Air Gun Laws	23
Air Guns vs. Firearms	25
The Blow Gun	33
The Mystery of the Bellows Gun	46
Transitional Spring Guns	54
American Gallery Guns	56
Primary New York City Type	57
Secondary New York City Type	61
Upstate New York Type	63
St. Louis Type	64
New England Type	69
Unknown or Questionable Makers	70
Quackenbush	72
Tinplate	78
European Pneumatic Arms, Introductory Remarks	79
Butt-reservoir Air Guns, Continental	80
Outside-lock Guns	80
Transitional or Concealed Variety	89
Austrian Butt-reservoir Air Guns	92
Barrel-surrounding-reservoir Air Guns, German and English	100
Ball-reservoir Air Guns, Continental	102
Ball over the Barrel	102
Berlin Bottom-ball	103
Walking-beam-lever	105
Bar-lock Air Guns	105
British Pneumatics	108
Air Canes	115
The Giffard Story	123
Pump-in-butt Air Guns	128
American Pneumatic Arms	129
Miscellaneous	133
Moderns—A Glimpse	136
Appendix I, Quackenbush Records	139
Appendix II, Air Gun Comments	143
Appendix III, Makers' List	153
References	186
Index	195

List of Illustrations

Figure		*Page*
1.	Off-hand Shooting, c. 1493	7
2.	Off-hand Shooting, c. 1472	8
3.	Saxon Matchlock Musket	8
4.	Musketeer Firing a Matchlock	9
5.	Bellows, c. 1495–1500	11
6.	Bellows-operated Hand Organ	11
7.	Hand Organ, c. 1375	12
8.	Bellows	12
9.	Marin's(?) Gun	13
10.	Von Guericke's Air Gun	15
11.	Von Guericke's Air Gun	16
12.	Comparative Penetrations	20
13.	Blow Gun Distribution	34
14.	The Primitive Blow Gun	36
15.	The Blow Gun in Medieval Europe	40
16.	Blow Cane Advertisements	44
17.	European Blow Guns	45
18.	Distribution of Bellows Guns	47
19.	Bellows Gun, Single-spring	52
20.	Bellows Gun, Double-spring	52
21.	Transitional Spring Guns	55
22.	Primary New York City Type Gallery Gun	57
23.	Primary New York City Type Gallery Guns	57
24.	Gallery Pistols	58
25.	Primary New York City Type Gallery Guns	58
26.	Secondary New York City Type Gallery Gun	61
27.	Upstate New York Type Gallery Gun	63
28.	a. Upstate New York Type Gallery Gun; b. New England Type Gallery Guns	63
29.	St. Louis Type Gallery Gun	64
30.	St. Louis Type Gallery Guns	65
31.	St. Louis Type Gallery Guns	65
32.	New England Type Gallery Gun	69
33.	European Trigger-guard-lever Spring Guns	71
34.	European Crank Spring Guns	72
35.	Quackenbush and Other Pistols	74
36.	Quackenbush and Haviland & Gunn Spring Guns	75
37.	Quackenbush and Foreign Spring Guns	77
38.	Tinplate	78
39.	Distribution of Outside-lock Air Guns	81
40.	Locks, Essential Types	82
41.	Outside-lock Air Guns	84
42.	Outside-lock Air Pistol; Fire Lighter	85
43.	Outside-lock Air Guns	86

Figure *Page*

44. Outside-lock Air Guns 87
45. Distribution of Transitional Type Air Gun 89
46. Transitional Type Air Guns 90
47. Distribution of Austrian Butt-reservoir Air Guns 92
48. Austrian Butt-reservoir Air Pistols 93
49. Austrian Butt-reservoir Air Guns 93
50. Austrian Butt-reservoir Air Guns 94
51. Barrel-surrounding-reservoir Air Guns 100
52. Ball-over-barrel Air Gun 102
53. Berlin Bottom-ball Air Guns 103
54. Walking-beam-lever Ball-reservoir Air Gun 105
55. Bar-lock Air Guns 106
56. British Bottom-ball Air Guns 109
57. Bate Bottom-ball Air Guns 110
58. British Air Guns—Late Type 112
59. Back-action-lock Air Guns 113
60. Cased Air Canes; Cane Gun With Trigger Guard 119
61. Giffard Guns 124
62. Pump-in-butt Air Guns 128
63. American Pneumatic Air Guns 130
64. Hybrids—Out of Time 133
65. Unique Unclassified 135
66. Modern Air Guns 136

Illustrations from Japanese text, Appendix II, included between pp. 145–151.

Preface

It was more than fifteen years ago that the seed of the present volume was planted. With the exception of certain changes of recent date, the manuscript was finished in 1955. At the time of its inception, it appeared that little material, either by way of specimens or records, was available. During the decade and a half of study and research the opinion repeatedly had been reached that the work was done, when, with persistent regularity, additional specimens and data came to light, causing amplification and alteration of conclusions. The field had been almost entirely untouched. Bits of material were available in an assortment of sources, but little of a definitive nature could be located.

When the mass of data mounted to impressive size, two volumes originally were considered. Ultimately, realizing that it would be necessary to publish available findings without waiting until, unquestionably, all was at hand, it was determined to limit the study to its present size and scope.

Here, then, will be found the development of the air gun, its history, forms, relationships, and makers. Bibliographical listings furnish sources for students who desire to go additionally into the subject.

During the years of study, arms enthusiasts were contacted in the hope of gathering additional data. Much was furnished and, in return, the findings herein presented were not withheld. It is with great satisfaction, therefore, that an upsurge in air gun interest is noted in numerous publications, including several books but, for the most part, specific topics in arms magazines.

The writer does not claim to have done the work alone. Without the whole-hearted cooperation of the arms-loving fraternity it would have been impossible to have produced this volume. Similarly, without the cooperation of the Milwaukee Public Museum, other students would have had the same difficulties that we would have experienced had this been the work of one person.

To list the names of all the friends and advisors would be impossible. To this large group, one and all, the writer expresses his deep appreciation. Individual opinions, where incorporated without mention, may be recognized. Where actual data are supplied, the source is listed in the bibliography. For inadvertent omission indulgence is asked. No list of data as varied as this can be prepared without some error.

We acknowledge with particular thanks the invaluable aid furnished in this study by the following: To G. Charter Harrison, Jr., for the use of specimens and data from his extensive collection, for the many pleasant hours of study of his materials, for his kind cooperation in gathering the photographs of his specimens for the museum's files, and for his valuable critical suggestions; to Samuel E. Smith, Wisconsin's most outstanding martial arms collector and widely recognized student and writer on arms topics, for his aid in the military aspect and developmental critique of this study; to L. C. Bewsey, for British records and information; and to Thomas Stich, a collector and student of Swiss arms, for

the use of his specimens and information. Translations thankfully acknowledged are those from French sources, by the late Helma L. Wolff, Librarian; and those from the Japanese, by A. J. Gillan, Supervisor of Property; both from the Milwaukee Public Museum.

The scope of the present work covers air guns from earliest times to about 1900, along with a glimpse into the present. It has been written in what is hoped will prove to be a readable fashion for the collector. It is not complete. New data are constantly coming to light; more are solicited.

Among the numerous articles which have appeared on the subject the following are suggested as additional reading, as they either amplify or present the views of other writers.

The Museum Record; Milwaukee Public Museum, Vol. 4, No. 1, July, 1947, Something on Air Guns; Vol. 6, No. 2, Oct., 1949, Blow Guns; Vol. 7, No. 1, Oct., 1950. Powderless Guns, all by Eldon G. Wolff.

The Gun Collector's Letter. The Gun Collector, Madison, Whitewater, and Milwaukee, Wis., No. 4, Dec., 1946, A Bouillet Pistol, G. Charter Harrison, Jr.; No. 7, Jan., 1947, A Repeating Rifle by Staudenmayer, F. C. Bewsey; No. 23, July, 1948, How an Air Gun Operates, G. Charter Harrison, Jr.; No. 36, June, 1951, Dated XVII Century Air Guns, Arne Hoff.

The Gun Report, Aledo, Ill. May, 1956, The Lewis and Clark Air Gun; Oct., 1956, The Miracle Gun; Sept., 1957. Haviland and Gunn to Quackenbush; Dec., 1957, The Saloon Gun, all by G. Charter Harrison, Jr.

Eldon G. Wolff

Historical Review

INTRODUCTION

Had Oliver Cromwell been assassinated by the air gun, so hopefully bought for that purpose; or had the American Continental Army adopted the air gun, as was presumably proposed at the time, and as Austria later did; and had Napoleon not taken such violent exception to the use of the air gun during his Tyrolean campaign, our subject would not be as obscure as it is.

The air gun is but casually known even to collectors of arms and students of arms history. In fact, by most people it is considered little more than an ineffective toy, judgment being biased by the popular air rifle (or BB gun) which technically is neither an air gun nor a rifle.

This weapon, toy, or gadget seems to have been with us in one form or another not only since the early days of firearms, but actually before. It is found even in savage cultures. For a subject as little known as the air gun there is a surprising quantity of information available, but this information, particularly as applied to the early days of the weapon, is unfortunately rather vague. It appears to have been invented by a number of different people, in different places, at different times, and in different forms. The major difficulty arises in determining what was invented. In most cases it is impossible to distinguish between blow guns, spring-activated bellows or piston guns, or true pneumatic compressed-air weapons.

Leonardo da Vinci (55, p. 793) mentions the air gun casually as a commonplace, using ". . . stones . . . like the balls of an air-gun . . ." as a standard of comparison. In another instance (55, p. 816) he deals with the construction of an air gun (really a barrel), describing its wire-wound structure and technique of manufacture, and giving not only the dimensions of the tube but also those of the steel dart to be shot therefrom. He describes no mechanism in connection with this barrel, which would lead one to believe that it was a barrel and nothing more, in other words, a blow gun.

That da Vinci should have mentioned the blow gun is not surprising, as this weapon was found in medieval Europe, as well as having been used in the primitive cultures of the Amazon River region in South America, among the head hunters of Borneo, and in our own southeast, among, for example, the Cherokee Indians.

It is unlikely that the early claimants to the invention of the air gun would simply have produced a blow gun, but instead probably would have developed some mechanical appliance for storing or compressing the air, or, in other words, a substitute for the lungs.

Of the mechanical contrivances for compressing the air needed for discharge, the most logical would appear to be the bellows. This instrument has been known since early times in recorded history and was described by numerous Greek historians. Strabo (225) ascribed the bellows to Anacharsis, but with the evident

conviction that these, the double anchor, and the potter's wheel were of an age far anterior to the Scythian philosopher.

The reason for considering the bellows gun as an early form of the air gun stems from the fact that most of such pieces now extant exhibit certain characteristics that are reminiscent of 16th century wheel lock guns. While no specimens have been authenticated as earlier than the late 18th century, the highly stylized construction and incidental mechanism of these pieces make it apparent that here is no sudden development. The principle upon which they operate is as follows: A bellows, confined within an iron housing, is found inside the hollow butt of the piece. To operate the bellows, it is expanded by a crank against the pressure of one or two powerful V-springs. In this connection it is well to note the link so commonly associated with wheel locks. The gun is discharged by having the bellows suddenly released through the agency of double set triggers and a uniquely contrived release bar which operates a sear near the butt plate. The involved chain reaction of this release is reminiscent of that used on the late, heavy crossbows and also on the wheel lock mechanism. Other similaritics, of which there are many, will be discussed in the chapter covering this type of gun.

GENERAL REFERENCES

Numerous references are found presuming to identify the air gun and to establish the earliest inventors and dates. Several features will be noted in them, these being an agreement in names, a reasonable agreement in dates, and sufficient similarity overall to cause one to wonder what the original sources were. There is a great possibility that most of the references are re-wordings of a common source. Another feature which is outstanding is the very apparent fact that but little was known at the time the references were made. Certain volumes go considerably into what should be the general subject, but actually is a detailed discussion, not always correct, of a certain type, which is almost invariably identified as "the air gun." Great variety does not appear to have been recognized by writers in the past.

In Brockhaus' *Konversations Lexikon* (33, *Windbüchse*) we find, "The air gun was apparently invented in 1430 by Guter of Nuremberg, although also Hans Lobsinger who lived in Nuremberg in 1566 has been called the inventor."

The *Dictionnaire Universel Des Sciences, Des Lettres et Des Arts* (66), 1857, states, "People do not agree as to the time of the invention of the air gun. One attributed it to Marin of Lisieux, and Guter of Nuremberg (1560). This invention was above all perfected in the last century by Jean and Nic. Bouilett, gunsmiths of St. Etienne and Paris."

According to August Demmin (58, p. 556) ". . . the air gun (German: *Windbüchse*) was invented by Guter of Nuremberg in 1560 and subsequently improved on by Gerlach and Sars of Berlin, Contriner of Vienna, Fachter of Liege, Martin Fischer of Suhl, Futter of Dresden, Schreiber of Halle (1760–

1769), C. G. Werner of Leipsig (1750–1780), Gottsche of Merseburg, Müller of Warsaw, Valentin Siegling of Frankfurt, a.M., Vrel of Coblenz, Jean and Nicholas Bouillet of St. Etienne, Bate of England, Facka Speyer of Holland, and others. It is a weapon in which the explosion is produced by compressed air which is provided by means of a pneumatic pump. Two varieties of air guns are known, one in which the reservoir is in the butt, and the other in which a ball reservoir is affixed either above or below the chamber of the weapon. This arm, which is forbidden in France, must be classified as a repeater, it being capable of discharging up to 20 bullets without recharging. Near the end of the 18th century the air gun served during the war in Austria, where it was a special weapon of certain companies."

According to Nicholson (177, Pneumatics), "The air-gun is a pneumatical instrument, of an ingenious contrivance, which will drive a bullet with great violence, by means of condensed air, forced into an iron ball by a condenser." Subsequently a description of a pump-in-butt air gun, similar to the Sars, and a ball reservoir flint-lock air gun is given, along with operation instructions. No suggestion of origin or date is given.

Charles Knight (143) says practically the same thing and also illustrates a Sars-type mechanism.

The air gun is identified in the New International Encyclopedia (131) as ". . . an instrument resembling a sporting rifle designed to discharge darts or bullets by the elastic force of compressed air. As ordinarily made, the air gun consists essentially of an air chamber or reservoir, usually located in the stock, of a condensing syringe for pumping air into a reservoir, and a valve operated by a trigger, which admits the compressed air from the reservoir to the barrel behind the bullet." The article goes on to say that a pressure of 500 pounds is secured in the reservoir, sufficient for a number of shots, and also suggests essentials of mechanisms.

The American Cyclopedia, (4) 1873, giving similar information, illustrates an air gun in which the barrel of the piece is supposed to serve as the pump cylinder, having a piston inserted into it. This device will be discussed later.

In like fashion many other encyclopedias present the then available data, none going into the subject sufficiently to indicate broad knowledge of the device. It remained necessary to analyze the problem by detailed study of specimens, correlation of contemporary mention, and interpolation by inference.

ANTIQUITY OF THE AIR GUN

Relative to the antiquity of pneumatic weapons, we have, as typical, the following: "The ancients were acquainted with some kind of an apparatus by which air was made to act upon the shorter arm of a lever, while the longer arm impelled a projectile; and it is said that Ctesiphus of Alexandria, a celebrated

mathematical philosopher, who lived B.C. 120, constructed an instrument in which the air, by its elastic force, discharged an arrow from a tube." (144, p. 47)

A statement is made in the Charles Noé Daly catalog (53, p. 14) that "There is also preserved in the Armory of Schmetan an air gun bearing the date of 1474." The earliest reference (1834) to this remark is found in the Journal of the Franklin Institute (84, p. 287) where the following is noted. "It is a curious fact, that although the air pump is a modern invention, yet the air gun, which is so nearly allied to it, in the construction of its valves and condensing syringe, should have existed long antecedent to it; for it is recorded that an air gun was made for Henry the Fourth, by Marin of Liseau, in Normandy, as early as 1408, and another was preserved in the armoury at Schmetan, bearing the date of 1474. The air gun of the present day is, however, very different from that which was formerly made, and which discharged but one bullet after a long and tedious process of condensation, while it now discharges five or six without any visible variation in force, and will act upon a dozen, though with less effect." This quotation will, in part, appear as source in subsequent notes.

Regarding this gun F. M. Feldhaus (78) comments as follows. "An air gun from the year 1474 is found mentioned by Musschenbroek in '*Introductio ad philosophiam natural,*' T. 11, #2111. It was found in the arms cabinet of the Lord of Schmettau in Germany. It was, however, very incomplete. The opinion regarding dates of such apparatus is always to be taken with care. I, however, find neither the time nor the place where the aforementioned arms cabinet was." The various spellings of the name Schmettau are understandable, because as any student of the German language will testify, a double "t" is frequently altered, in translations into English, into a single. Also, if one does not observe closely, a lower case "u" can be misread "n." With this and the corroboration of date in mind, we can assume that these references are to the same place. In the *Brockhaus Konv. Lexikon* (33, Schmettau) the following is found. "Schmettau, Samuel, Count von, Prussian general field marshal, grand master of artillery, born March 26, 1684 at Berlin . . . died August 18, 1751 at Berlin." He saw service, according to the article, in Wars of the Spanish Succession, in Poland, Sicily, and Italy, against the French in the Rhine countries, against the Turks in Belgrade, etc. No indication is given as to a location such as Schmettau. It is probable that the *von* is a noble accessory to an existing family name, commonly employed in high military rank, although the *Count* should normally indicate the name as that of a place.

The quotation from Pieter van Musschenbroek, given by Feldhaus, seems to indicate that the above Count von Schmettau was the owner of the arms cabinet. Musschenbroek lived from 1692 to 1761, and his book was published posthumously in 1762. Schmettau was Musschenbrock's senior by eight years and preceded him in death by ten. No more detailed reference to Schmettau has been found, nor is any information presently available as to his possessions.

According to Feldhaus (78) the earliest inventor of which there is any record is Guter of Nuremberg who is supposed to have invented an air gun in 1430.

There is a suggestion of doubt and confusion regarding this reference, as admitted by Feldhaus who quotes the statement and says thereafter:

"Guter is first identified in J. C. Vollbeding's *Archiv der Nützlichen Erfindungen*, Leipzig, 1792, p. 518. It is remarkable that the two worthy Nuremberg chroniclers, von Murr (*Beschreibung der Merkwürdigkeiten in Nürnberg*, 1801) and Soebenkees (*Kleine Chronik Nürnbergs*, 1790) know nothing regarding this inventor. In the work of the latter it is announced that in 1429 people shot with *Büchsen* at marks; however, that this occurred with air guns is not stated."

Gustav Freytag (85) gives a surprising amount of data regarding the German shooting festivals which arose about 1300 and continued for five centuries thereafter. The descriptions of shooting techniques suggest firearms, in addition to crossbows, but the innovations and changes noted would allow the use of air guns also. They are, however, not noted. The following points lead one to wonder precisely what arms were used.

The Nuremberg Chronicle of 1493 (44), now in the library of the Wisconsin State Historical Society, shows an illustration of a man shooting off-hand with an unidentified light gun at a disk target (Fig. 1). From what is known of firearms

Fig. 1. Off-hand Shooting, c. 1493.
From *Chronicon Nurembergense*. The shooter is shown left-handed, probably due to a reversal of the original engraving.
(Neg. 195687)

of the period, off-hand shooting at a mark seems unlikely, although target shooting with guns was already established (85). M. Thierbach (228, p. 7), discussing the development of the matchlock, says, "This improvement, which now first made possible the striking of a target, can be set in the first half of the 15th century, 1420 1440." He, however, neither suggests what the target could have been nor describes the means of holding the arm while shooting. The improvement is identified by him as one over the hand cannon.

In support of the possibility of off-hand shooting of a hand cannon or matchlock, Sir Ralph Payne-Gallwey (184, p. 8) illustrates a drawing from Valturius (Fig. 2), edition 1472, in which, in company with crossbowmen, gunners are

shown firing in a sort of off-hand fashion. R. C. Clephan (45, p. 63, fig. 22) illustrates a harquebusier of the reign of Maximilian I, c. 1500, firing a very heavy matchlock off-hand, an apparently difficult undertaking.

Thierbach, however, later discusses (228, p. 24), and illustrates (228, fig. 40) a Saxon musket and forked rest as dating from the time of Duke Christian II,

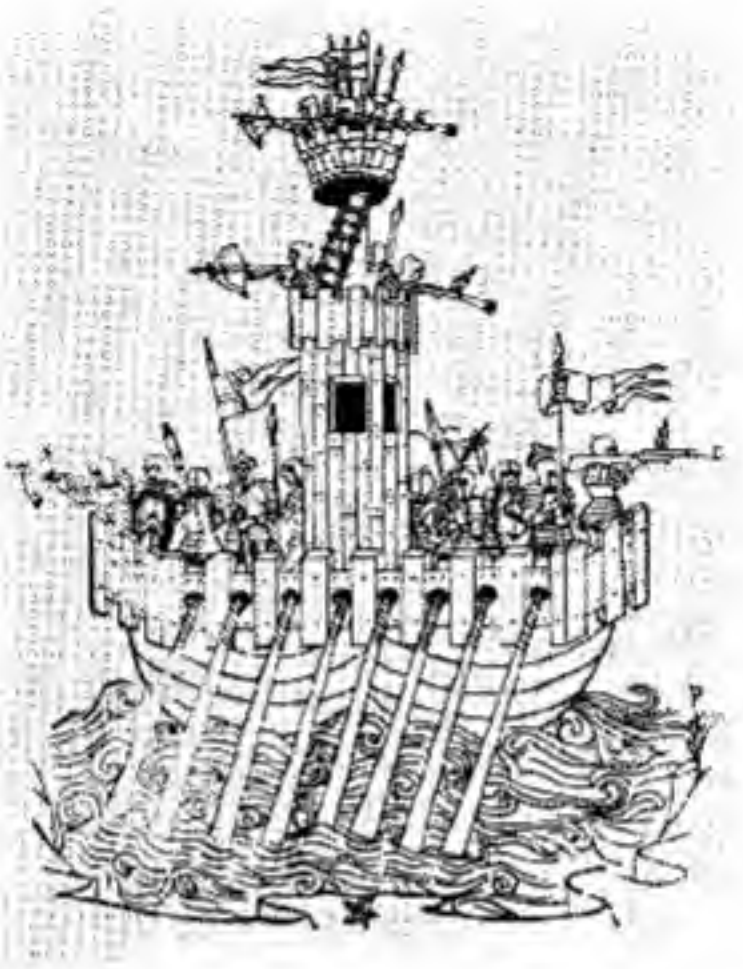

Fig. 2. Off-hand Shooting, c. 1472. From Payne-Gallwey, quoting Valturius. (Neg. 195693).

at the end of the 16th century (Fig. 3). The use of the forked rest with the slowly igniting matchlock is understandable.

J. Schön (209, p. 31, fig. 36) states that the arms were lightened near the end of the 16th century, but that the musketeers of the time included in their equipment a forked rest for the matchlock musket, and illustrates its use (Fig. 4).

This incidental information is indicative of the reasoning which has led us to wonder whether the *Büchsen* which were "shot at marks" and the poorly illus-

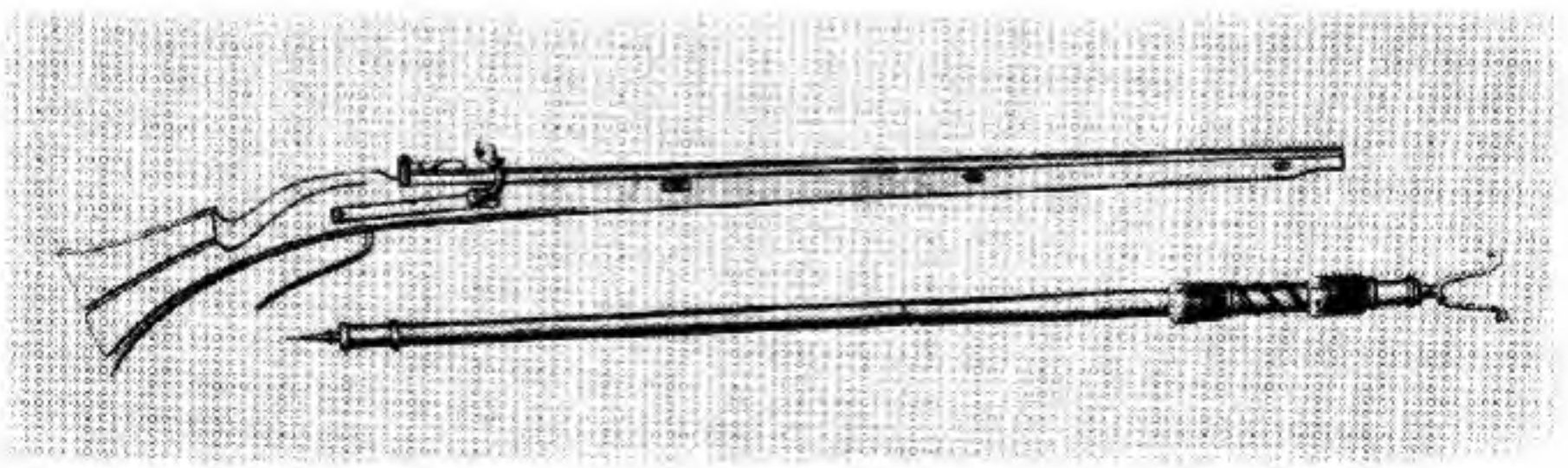

Fig. 3. Saxon Matchlock Musket. End of the 16th century. (Neg. 195692)

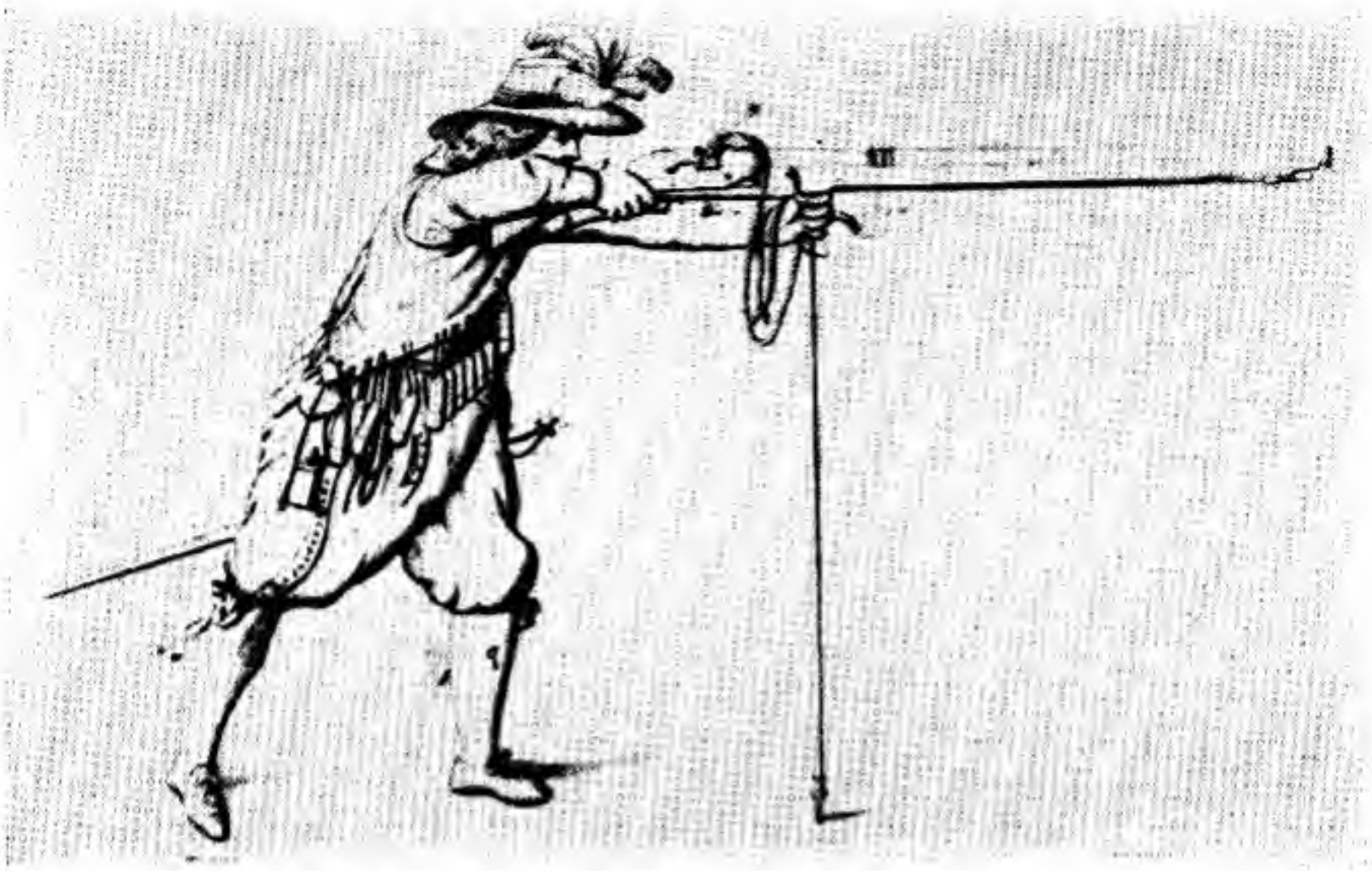

Fig. 4. Musketeer Firing a Matchlock. End of the 16th century. (Neg. 195689)

trated targeteer in the Nuremberg Chronicle of 1493 might not indeed in instances be references to air guns, probably of the bellows type.

Regarding the etymology of the German word *Büchsen,* attention is called to the source of a related term, harquebus (or arquebus), which is identified (242) as a combination of the Italian words *arco* (bow) and *buso, bugio* (hollow, pierced). This would indicate the possibility of the original harquebus having been something similar to a slurbow or perhaps a bow-powered piston or air gun. The German form of this word is *Hakenbüchse,* identified as an arquebus or a hook gun (226, p. 33). The latter portion of the statement appears to be an apology for lack of information, inasmuch as the old hand cannon that have the hooks for presumed support on ramparts have no resemblance to the arquebus as commonly identified.

There is no clearly delineated trail in German for *Büchsen.* If it means box, as has been popularly claimed, it has no association with a firearm. Were it to actually mean box or bellows, not only would the term be explained, but the early reference and illustration would definitely point to the air gun. Realizing the problem of complexity in linguistic origins for the word, it is admitted that a great deal of probability is involved here, as true in so much of the analysis of the early air gun.

We also find the date of 1560 given for Guter's supposed invention of the air gun (58, p. 556). This date is the same as that ascribed to Hans Lobsinger, also of Nuremberg. Here we have an authenticated individual and we also have a clue as to the type of mechanism he could have produced. Lobsinger was one

of those gifted individuals who operated and made a name for himself in several fields, and it is to this happy circumstance that we can arrive at the possible nature of his invention. According to Feldhaus (78), in 1550 Lobsinger deposited with the magistrates of the city a description of several of his inventions, one of these being an air gun. The actual description is lost, but a record of its deposit remains. It was not published, but Doppelmayr gives similar information regarding it in his *Historischen Nachrichten von Nürnberger Mathematikern und Künstler, Nürnberg,* 1730, *Anm. XX.* According to a note in Soebenkees' Chronicle, Lobsinger invented an air gun about 1560. Inasmuch as here the time, place, and person are definitely given, one can credit greater possibility to the accuracy of the statement.

In Beckman's History of Invention (15, p. 63) we find considerable information regarding Lobsinger and his bellows, from which it would appear that Lobsinger's air gun either consisted of some kind of bellows-operated mechanism or else a spring-driven piston, of the order of a syringe, although Edward Hopkins (128, p. 76) is more specific. He says, "In 1570 Hans Lobsinger, of Nuremberg, invented the bellows with one fold, which is still found in old organs." The original source is, unfortunately, not given, and, aside from the acknowledgement of his invention, we cannot be assured of Lobsinger's design. Nor does this author interest himself further.

A transcript of Beckmann's words (15, p. 66) illustrates the varying possibilities which have been accepted piecemeal by a number of writers. "In the middle of the sixteenth century lived at Nuremberg an artist called Hans Lobsinger, who, in the year 1550, gave to the magistrates of that city a catalogue of his machines. From this catalogue Doppelmayer concludes that he understood the art of making small and large bellows without leather, entirely of wood, which could be used in smelting-houses and for organs, and likewise copper bellows that always emitted a like degree of wind. As Lobsinger made organs, he, perhaps, fell upon this invention; but in what it actually consisted, or whether it might not have died with him, I have not been able to learn. Agricola, who died in the year 1555, makes no mention of wooden bellows."

It is quite reasonable that Lobsinger's would not have been a true pneumatic gun in which compressed air is stored in a reservoir pending release by a valve mechanism. This is somewhat borne out by E. h. K. Maleyka's statement (163, p. 1) that I. B. Porta describes an air gun in his *Magia naturalis* (1589), which contained a brazen cylinder for the compression of the air (a syringe?).

Lest there be any doubt regarding these claims of the existence of a bellows in acceptable form for a gun at this date, we refer to certain illustrations which not only prove our contention, but also show in detail what bellows were known.

The famous Nuremberg artist, Albrecht Dürer, who has been recognized for his meticulous detail, illustrates a bellows (67, No. 106) in his "Torture of St. John by Domitian," attributed to the period 1495–1500. The instrument is there shown used to blow up a fire (Fig. 5).

Hans Memling (1430–1495), the Flemish painter of portraits and religious subjects, illustrates (170) a number of bellows in connection with hand organs of a peculiar design, showing the bellows from various angles and in considerable detail (Fig. 6).

Fig. 5. Bellows, c. 1495–1500. From Dürer's "Torture of St. John by Domitian." (Neg. 195688)

Fig. 6. Bellows-operated Hand Organ. From Memling's shrine of St. Ursula. 1489. (Neg. 195686)

While the hand organ is not shown in detail, a depiction of it (Fig. 7) exists on a monumental brass dating c. 1375 (113, pl. 17).

It takes but little imagination to visualize the development of a bellows gun from such an organ, the structure appearing very similar (Fig. 8). The truly curious fact is that such a device was not hit upon sooner than it was. Another item which strikes one forcibly is the fact that the hand organ does not appear to have been used in Nuremberg in Dürer's time, inasmuch as he never illustrated it. Presumably he was not acquainted with it, else why did he not include it in at least one illustration?

Fig. 7. Hand Organ, c. 1375. From a brass monument, England. (Neg. 195690)

Whether Lobsinger's bellows was a new invention in Nuremberg we frankly cannot be certain. He could, reasonably, have heard of the hand organ through a traveler, or even visited Flanders himself, and thereafter applied the mechanism to the organs which he made, as an improvement over the water-and-cask bellows previously used. Subsequently he could have been popularly credited with the invention.

Relative to the matter of a syringe, Sir E. A. Wallis Budge, in his monumental work, "The Mummy" (37, p. 204), quoting Carey's translation of Herodotus, describes the use of the syringe in the embalming of the dead of ancient Egypt, stating, "When they have charged their syringes with oil made from cedar, they fill the abdomen of the corpse without making any incision or taking out the bowels, but inject it at the fundament. . . ." The operation as described by Herodotus precludes the possibility of mere reeds having been employed through lung power.

A variety of air syringe or bellows is found in branches of the Indonesian cultures. This device consists of a cylinder into which is fitted a piston and

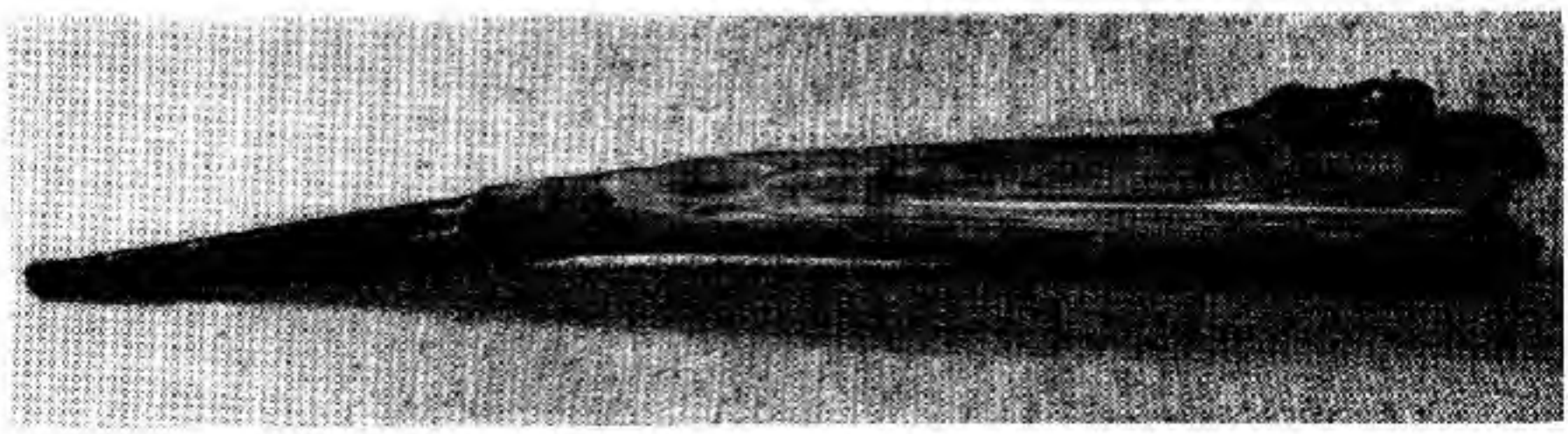

Fig. 8. Bellows. From a single-spring bellows gun by Jos. Mond. (Neg. 426832)

driving rod. The valve effect is produced by a packing of cornhusks and chicken feathers which, in the retracting motion, permit the entry of air into the cylinder but nominally prevent its exit by any other means than the correct port (47, p. 415). Admittedly, the device is far from airtight, but it is sufficiently effective to permit its use in the smelting of metals. While it is impossible to date the mechanism, the spread of the culture of which it is a component is sufficient in area and in recognizable age to indicate the remote antiquity which is associated with the working of metal.

Considering the matter of crediting the invention of the air gun to any single individual, without further investigation, Feldhaus says (78, p. 272), "One might just as well credit the Alexandrian Ctesiphus with a shoulder weapon because even he is identified as the inventor of an air-gun out of which one could catapult stones."

THE AIR GUN AS AN ACTUALITY

It is not until we reach the late years of the 16th century that we can definitely say that a true air gun has come into being. About 1602, if not earlier, according to Knight's American Mechanical Dictionary (144, p. 47), Marin le Bourgeois of Lisieux designed a pneumatic gun which was seen at that time by David Rivault and published in his *Elemens d' Artillerie*, printed previous

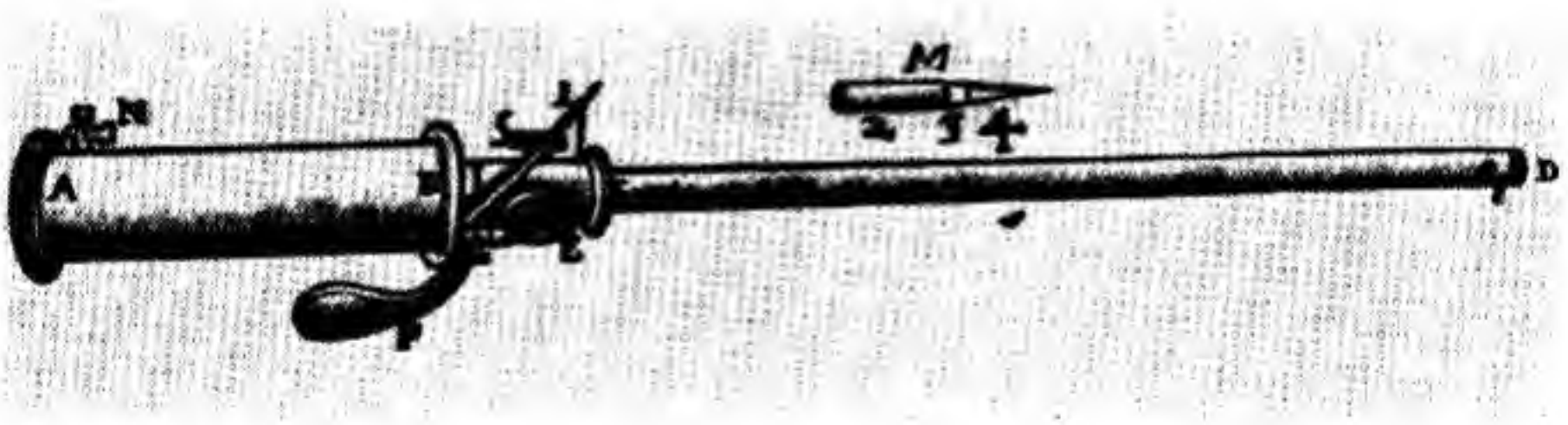

Fig. 9. Marin's (?) Gun.
From an undated copy of *Magasin Pittoresque*, labeled, "Air gun believed to be by Marin Bourgeois, French artisan." From an original owned by Dr. Stephen V. Grancsay.
(Neg. 195928)

to 1608. This air gun was exhibited before Henry IV of Navarre. Hugh B. C. Pollard (186, p. 122) states that it was presented to Henry of Navarre prior to 1600 (Fig. 9). Marin le Bourgeois, according to the Wallace Collection Catalog (164, p. 348), was the brother of Jean le Bourgeois, a watchmaker and gunsmith of Lisieux.

There is considerable confusion regarding the name of le Bourgeois, in the clarification of which we have been assisted by Dr. Steven V. Grancsay (101). As it can readily be translated "citizen" (Fr. *bourgeois*), he is usually referred

to in arms works as "Marin, citizen (or *bourgeois*) of Lisieux." Accordingly, we have one series of data for this talented individual recorded under the name of Marin (or also Martin), and another regarding both him and his brother Jean recorded under the name of Le Bourgeois.

One writer in the *Biographie Universelle* (26), dealing with the life of Marin, "citizen of Lisieux," is surprised to find that no other biographer had mentioned so extraordinary an artist. This is by no means the only instance of confusion regarding the men whose names have been associated with the early forms of the air gun.

An excellent example of this confusion is the reference to be found in the Daly Catalog (53, p. 14), which gives us the earliest date for the invention of the air gun thus far found: "The air gun . . . dates back to the 15th Century, . . . as indicated by a record in the Castle of Henry 4th at Poe, indicating that an air gun was made for him in 1408." The danger with any date which is the earliest for anything is that it may be picked up blindly and used to the exclusion of later dates that may be far better authenticated. In this case it is apparent that whoever compiled the catalog remembered a previous reference to an air gun which was made for Henry IV of Navarre, obviously that of Marin. In checking the dates of Henry IV, the compiler inadvertently took Henry IV of England (who was born 1387, ruled from 1399 to 1413, died 1422), thereby placing the date of the invention of this air gun ahead precisely two centuries. There is little question about the error, as Henry IV of Navarre (born 1553, ruled 1589 to 1610) had a castle at Pau, not at Poe as given in the Daly Catalog, which would be carrying coincidence too far. In substantiation of this, Lippincott's Pronouncing Gazetteer (159, p. 1413) gives this information: "PAU, (po), a town in France . . . Pau was the capital of the old province of Bearn. Henry IV was born in its ancient royal castle." All attempts to locate a town or castle of Poe (in any phonetic form) in England failed.

One of the interesting references to the air gun in the 16th century is that given in the Autobiography of Benvenuto Cellini (42, p. 370), in which he says, ". . . a shower of hail began to fall. . . . At first the hail was somewhat larger than pellets from a popgun, and when they struck me, they hurt considerably. Little by little it increased in size, until the stones might be compared to balls from a crossbow. . . . The hail now grew to the size of big lemons." This was written about 1544.

The well known name associated with the early development of the air gun is that of Otto von Guericke, the Mayor of Magdeburg, who is better known for his famous Magdeburg hemispheres. In connection with the air gun, von Guericke is often credited with the invention of the air compressor (131, Air Compressor). This is possible, although the pump that von Guericke is known to have employed was the exhaust pump for creating a partial vacuum. It is not definitely stated whether the Mayor described his own invention, but he is supposed to have described an air gun of the compressed air type, one which today would be considered an unusual construction.

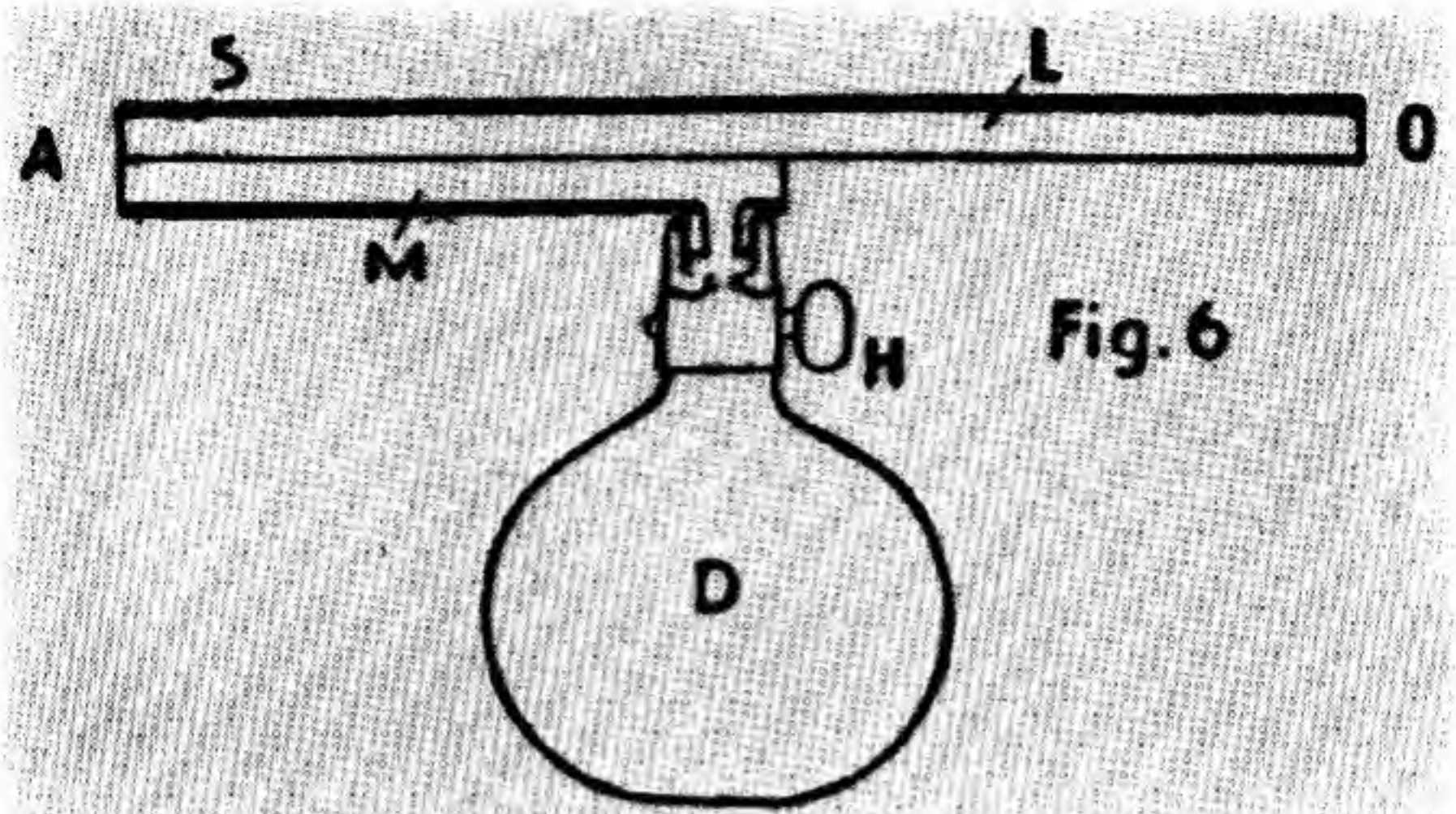

Fig. 10. Von Guericke's Air Gun. According to Maleyka. (Neg. 195927)

The air in this arm (Fig. 10) is presumably compressed by the act of seating the bullet, encased in a leather wad, into the barrel by means of the ramrod, the air in the barrel being compressed thereby. When the ball is seated, the air is held confined in an adjacent reservoir by means of a petcock. Turning the petcock permits the compressed air to escape suddenly into the barrel and drive out the bullet and wad, presumably without much force. Maleyka (163, fig. 6) illustrates a portion of this mechanism and identifies it as von Guericke's. Feldhaus (79, p. 368) shows a cannon which appears to be similarly constructed, but says nothing about it. He does, however, note (78, p. 272) that "Nuremberg craftsmen prepared air cannons out of which it was possible to shoot four pound balls 400 paces through two inch boards."

Maleyka remarks (163, p. 5) that the air in such a load-compression gun would be under about one atmosphere of pressure. It is, however, questionable whether this device would function at all in the manner described. A possibility exists of the barrel having been the cylinder of a pump and that, by repeated thrusts with a properly headed ramrod-piston, a reasonable compression of air in the reservoir might have been attained. Even so, the efficiency of the device would have been very low, certainly too low for a cannon. What complicates the matter is the fact that no normal valve is present; instead, a faucet is provided for releasing the air. Such a device would be difficult to operate in connection with a pump.

An oft-repeated rumor might not be amiss here, inasmuch as we are still dealing with probabilities. It would have been feasible to place a proper quantity of gunpowder into the reservoir, which, in the case of the cannon, appears to be quite strong, and thereafter ignite the enclosed powder by heat. The resulting

gases trapped within the reservoir could then be released at will in discharging the weapon (Fig. 11).

Whether this probability is reasonable or not may be decided by the evidence of the Sims-Dudley pneumatic gun. Quoting the New International Encyclopedia

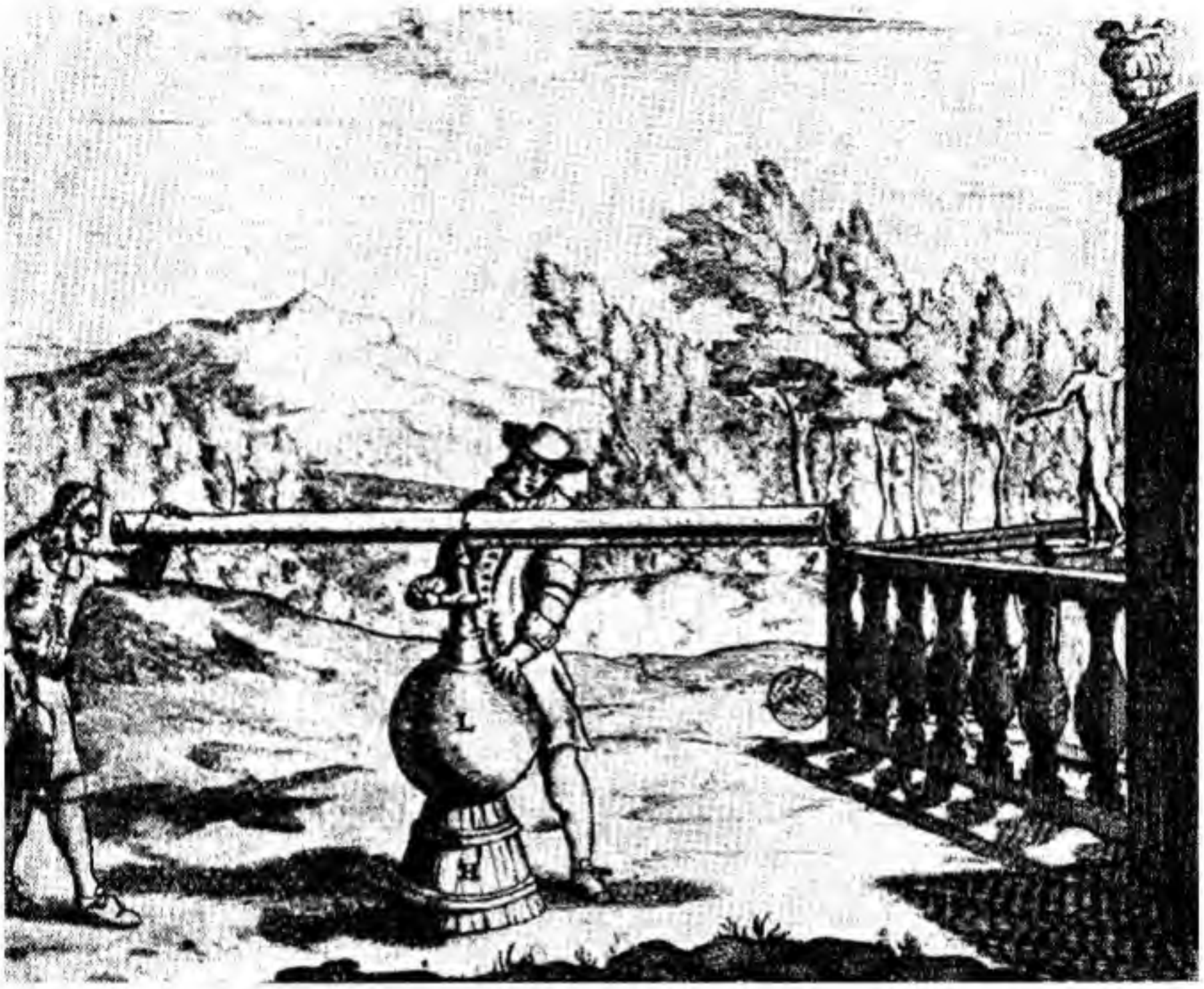

Fig. 11. Von Guericke's Air Gun.
According to Feldhaus. The original source is unknown. The stand upon which the ball rests may be a furnace for indirect ignition of gunpowder in the globe, thus producing gases for discharge.
(Neg. 195691)

(131), the Sims-Dudley was a field cannon with a range of from 2600 to 3600 yards. It consisted of a lower, or combustion tube, 7 feet long and 4½ inches in diameter, and an upper tube, or barrel, 20 feet long and 2½ inches in diameter, mounted on a regular field gun carriage. A cartridge inserted in the breech of the combustion chamber and containing a 7- to 9-ounce charge of smokeless powder, is fired; this compresses the air in the lower chamber so that it passes into the upper tube or barrel behind the projectile and forces it out. The projectile was a tight casing, filled with explosive, fired by a time fuse, or by a contact fuse upon striking.

In 1886 Lieut. E. L. Zalinski of the United States Army was involved in the invention of a pneumatic gun for throwing projectiles filled with dynamite. The

Vesuvius, which was later built for the United States Navy, was equipped with three of these guns. The range was considered too small and the accuracy of fire insufficient to make it a serviceable weapon on shipboard (131).

PRELIMINARY SPECIMEN ANALYSIS

Gradually, after the long meander through the realms of historical probability, it is possible to arrive at a point in the development of air guns where, although questions still present themselves, actual specimens are available for analysis.

While the story from here on will be developed in some detail in succeeding chapters, a brief resume will serve to point out the items of importance and the relationships of the various types.

The earliest variety which can be fitted into the series is the unnamed one which we call the outside-lock pneumatic. Arms of this type have butt-reservoirs, basically similar but intrinsically different locks, and simple barrels. The outside-lock pneumatic gun is usually not marked with the maker's name. From the standpoint of its essential lock mechanism it assumes a definite place in the evolution of the true air gun. It appears to have given way to pneumatic guns in which the reservoirs were enclosed in the hollowed-out butts, the discharge mechanisms of which followed the principle of the outside-lock, but were built upon the flint-lock mechanism. Actually, these pieces look like flint-locks and can, if but casually examined, pass for them. This type of weapon has been found marked with names of known individuals dating around 1750.

The mechanism does not appear to have been standardized for some years, however, and transition examples exist in which the air pump for filling the reservoir became an integral part of the arm, it being placed in the butt, and the reservoir thereupon being moved ahead into the wrist and, in instances, around the barrel. The latter is the Sars type mentioned previously.

Another line of development occurred in the production of the removable ball-reservoir, a variety which assumed great importance and survived for a considerable length of time until it became known as the "old dangerous system of globe reservoirs" (200, p. 8). Following the ball-reservoir we find the cane gun in which the reservoir could be located either in the rear portion of the arm or surrounding the barrel.

It appears that the pneumatic weapons to this point in their developmental history are repeaters, that is, the compressed air in the reservoirs was not exhausted with a single discharge. As many as twenty to forty shots are possible with a well filled reservoir. Single shot pneumatics, with few exceptions, are remarkably recent and current, such examples as the Crosman, Rochester, Apache, and Sheridan being quite familiar to American readers.

At an unknown date a divergence occurred which ultimately resulted in the production of a radically different type of weapon, the spring gun, which employed

air for discharge, but did not have the air under compression until the instant of use. The presumably earliest variety, the bellows gun, has already been noted. It is in reality a form of spring gun, the release of the cocked spring furnishing the power necessary for the momentary compression of air.

The basic peculiarity of all spring guns is the lack of a valve and reservoir, which eliminated the necessity of a pumping system. Also, these pieces are of necessity single-shot weapons. The power of spring guns is relatively limited.

The common characteristic of spring guns, aside from the bellows type, is the use of a piston and cylinder—actually a form of pump or syringe. It can be identified as a simplification of the pneumatic gun, the pump itself being employed directly, spring impelled, instead of being an intermediate device for charging a reservoir.

Spring guns of complex form became quite prominent in America shortly after the Civil War period. They were developed further in simplified form, primarily in Quackenbush arms, and then, except for continuation as BB guns, left this country entirely. They became important thereafter in Europe, where the pneumatic gun was displaced until its production ceased entirely. At present, spring guns are the rule in Europe, and light pneumatics in America, completely reversing the situation which existed in the last century.

THE AIR GUN AS A WEAPON

The use of the air gun in the past for hunting was surprisingly extensive, although very limited in militias. Laws regulating it have been widely quoted.

Malcyka (163, p. 3) includes an interesting section on air guns as hunting weapons in which odd facts are brought to light. Quoting the unnamed author (Count von Mellin?) of a hunting book produced in 1779, he says, "For shooting one has two varieties of guns, first those out of which the lead is shot by means of powder, the second those out of which the lead is driven through the pressure of air. The first is called a sharp gun and the latter a windgun. . . .

"In the same hunting book of 1779 it is stated that generally three hundred strokes of the pump were necessary to fill the ball (reservoir) with air. This air was sufficient for from twenty to twenty-four shots. With the first six shots the lead bullet is claimed to have been able to pierce a deer at from seventy to eighty paces. The subsequent shots were, with gradually reduced pressure in the reservoir, weaker. Guns also were claimed to have been made which permitted greater volume of compressed air to pass out when the reservoir was opened by proper pressure upon the valve.

"A counting device affixed to the gun informed one of the number of discharges, simplifying the counting process for the shooter.

"According to old reports, as for example, 'das Schiesswesen,' the German hunting paper of November 30th and December 17th, 1905, Louis VIII, Land-

grave of Hessen (1691–1768) preferred to use air guns rather than firearms for big game hunting. In the rutting season of 1747 this ruler, with his air gun, brought down a 22-point stag of 480 pounds weight in Battenberg. The antlers weighed 24½ pounds. Many great deer and an unnumbered amount of wild boar are claimed to have fallen sacrifice to his unerring air gun.

"The Experimental Station of Neumannswalde in 1905 (Schiesswesen Deutsche Jägerzeitung, Dec. 17, 1905) inspected and experimented with an air gun from the arms collection of the Schloss Pfaffroda in Saxony where it had been placed for keeping. The 9.5 mm. round bullet was wrapped with thin paper and targeted at a total shooting range of approximately 500 meters. At a 35 meter distance a 3 cm. fir board was pierced. The flight speed amounted to about 200 meters per second.

"With due respect to the value of the gun as a museum specimen and to be on the safe side, the reservoir was filled with only 100 strokes in spite of the fact that in its time it was intended for more. The result of the investigation was that the penetrating power of the air gun in question was sufficient, upon extreme pressure upon the valve, to kill big game at a distance of 100 paces.

"Fine shot has also been fired out of air guns, for which purpose a wood or paper wad was first loaded into the barrel. Aside from smoothbores, guns which had straight rifling found use with shot."

Maleyka's quotations will bear comment. It is interesting to encounter a hunting book which gives details on air guns, and particularly one which identifies them by name. The German word for air gun is *Windbüchse*. The word "wind," i.e. movable air, is identified instead of simply air. Occasionally one encounters English references to wind guns also, a possibly literal translation from the German where it was presumably first identified. The French term *fusil a vent* identifies the weapon as a gun with a valve.

We have encountered a reference to an existing air gun which has a counting device affixed. This operates with gears and is reminiscent of the footage indicator on a motion picture camera.

The suggestion of penetration and resulting effectiveness is quite reasonable in view of our experiments. A pressure of 750 pounds per square inch of carbon dioxide was introduced into a ball reservoir and a bullet discharged from a rifled air gun. Penetration effectiveness was realized when the hard pine boards which served as a target were split. A Kentucky rifle was then tested under similar circumstances, using 35 grains of FFG powder. The Kentucky bullet penetrated only a half inch deeper than that of the air gun, its extreme penetration being only two and one-half inches (Fig. 12).

A strange phenomenon is here apparent. The air gun is, from the standpoint of pressures used, decidedly more efficient than the fire arm. It appears that gas, confined under pressure and then suddenly released, has a relatively more powerful

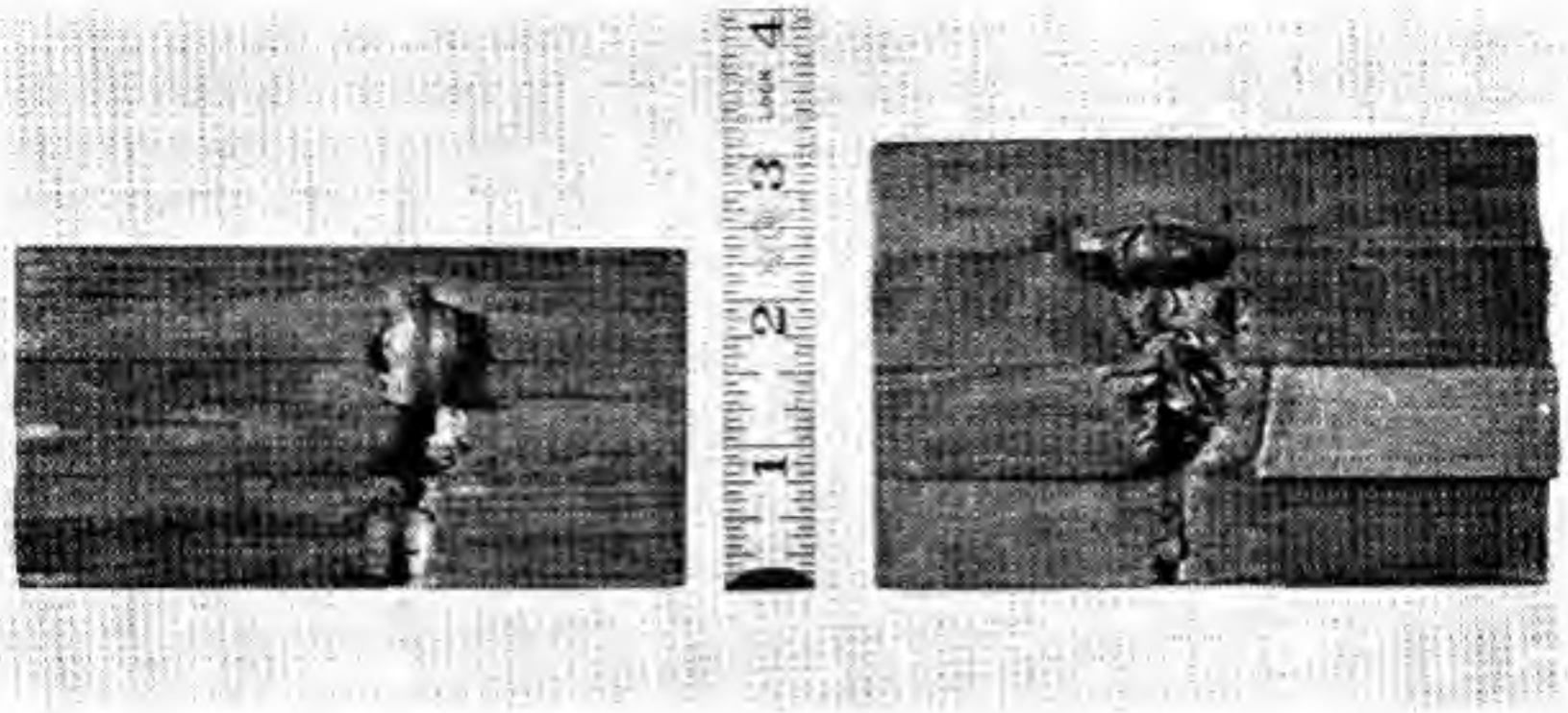

Fig. 12. Comparative Penetrations.
Upper: From a ball-reservoir air rifle. Reservoir pressure, 750 pounds of carbon-dioxide.
Lower: From a Kentucky rifle. Load, 35 grains FFG black powder.
Both shots were made at a range of about twenty feet. The dissimilar bullets were designed for the guns in which used.
(Neg. 126066)

effect upon a projectile than has the nascent gas generated by the burning or explosion of gunpowder.

Realizing that the Kentucky rifle has been proven effective against deer, elk, and buffalo in North America, we can well accept the report of the 480-pound trophy brought down by an air gun in Battenberg.

Relative to the matter of air shotguns, we have successfully employed a breech-loading arm of the Austrian type against a variety of small game.

It might be questioned why air guns are not built for more extreme pressures and thereby become more effective. This is answered when one remembers that gas liquefies at definite pressures and, depending upon the gas used, automatically limits the arms. In the case of a liquid carbon dioxide gun, such as the Giffard, the fluid must volatilize before it can be employed, the pressure of the gas at that point, at a given temperature, being theoretically constant.

Maleyka notes the presumed effectiveness of the arm used at Neumannswalde, stating that the penetrating power of the air gun in question was sufficient, upon extreme pressure upon the valve, to kill big game at a distance of 100 paces. This frequently repeated remark, which indicates an adjustable trigger-valve mechanism, remains to be proven. If we assume that the pressure on the valve was an internal one, actually the pressure in the reservoir, instead of an adjustable pressure by the trigger upon the exit or outer side of the valve, the expression, "extreme pressure upon the valve" makes sense. It is hard to understand why the reservoir pressure was not so identified, unless it was the peculiarity of Maleyka's phraseology. The balance of his article, however, is very clear.

An adjustable trigger, or as has been so frequently suggested, a variable one, is precisely what is not wanted in an air gun. An adjustable trigger would have

to be altered so frequently to compensate for pressure losses as to be more or less of a nuisance. Also, a trigger with a variable potential is undesirable because, without any effort, one might hold back too long on the trigger and expend the contents of the reservoir in one blast, a disconcerting experience, indeed! None of the mechanisms which we have examined has more than the firm, almost instantaneous thrust against the valve to open, and thereafter an absolute release to permit closure. This device is invariably between trigger and valve; no direct trigger-to-valve control has been found except in cases of single shot weapons where it is acceptable. If ever one existed in multiple pressure arms, it has either been altered or discarded. Incidentally, no alterations from such a possible system have been encountered. Normally, reduced pressure within a reservoir slows down the valve closure, compensating for pressure drops. One model of the Giffard, with an adjustable hammer stroke, is a possible exception of doubtful value. Some current gas guns are similarly equipped.

We are indebted to Mr. L. C. Bewsey for additional notes on hunting with the air gun, and can do no better than quote his remarks completely.

"Baillie-Grohman, author of 'Sport in the Alps,' mentions the use of air guns for red deer shooting in Germany during the seventeenth century." (17.)

"'Colonel Thornton's Sporting Tour in France,' quoted in Johnson's Sportsmans Cyclopedia—'After trying for a considerable time we at length found; and the hounds having a good scent, ran tolerably for about two hours, during which time I got only one view of the game: however, he soon began to run shorter in rings and lie down; and as the sun got up the scent became weaker. I then dismounted and took my stand under an oak, intending to have a shot at the roe-buck with the air gun which had succeeded so well at the wild boar, but before I could pull the trigger, he was in thick covert.

"'After a few rings and cold hunting, we came within twenty yards, when I discharged my piece, and was convinced both by his springing and the sound of the ball, that I had hit him. I gave several view halloos, but the company either did not hear or could not understand me; although had I shot with powder, they must have been apprised by the report.

"'After some further running . . . I rode before him, and put a ball between his eyes.

"'The rest of the company soon came up, and were highly delighted, but the keepers could not comprehend the nature of an air gun, though they carefully examined the piece, and the effect of the ball. It must, in this instance, have shot very weak, or the first shot must have gone through the deer's head; but it had broken the shoulder, and being turned by the bone, had come out through the skin of the neck. This was deemed very extraordinary; but I once shot a deer with the same gun, at Thornville Royal, which was in the act of leaping a fence; the ball went in at the shoulder exactly opposite the heart, but it turned at the belly between the skin and the intestines, and came out at the hock.'

"The Colonel (1757–1823) is considered a pretty reliable writer. Sir Walter

Scott in reviewing his 'Tour through the Northern Parts of England and the great part of the Highlands of Scotland,' took exception to the great amount of technical sporting details therein, but this peculiarity just suits *us*. The French tour took place in 1802.

"From T. B. Johnson's 'Sportsman's Cyclopedia,' 1831, article 'Air Guns,' after a very general description:—

" 'For buck or deer shooting the best air gun is not sufficiently powerful; for rook shooting it is very well calculated, and could we stop here, it would be very well, but this mischievious instrument has sometimes been applied to the most diabolical purposes; and at length has found its way into the hands of the poacher who willingly uses it for nocturnal depredations.'

"I consider the last part of this most happily phrased. The 'Cyclopedia' has about one thousand pages of such stuff! Now for the poacher's opinion.

"From Richard Jeffrres' 'The Amateur Poacher,' second edition, 1881. The speaker is 'Oby' the author's 'professional' friend:—

" 'I had a air gun once as was took from me, but he weren't much go; I likes a gun as throws the shot wide, but I never shoots any but roosters, unless I can catch 'em standing still.' " (21.)

The use of the air gun as a military arm has been limited, according to available information, to the Austrians. Such effectiveness was experienced by the opposing French troops during the Tyrolean campaign that Napoleon ordered the summary execution of any Austrian found with an air gun. This weapon will be included in a later chapter.

While the statement remains to be proven, the Catalog of Ye Olde Curiosity Shop (undated, but c. 1925) includes a suggestion of experimental use of air guns by the Continental Army during the American Revolution. No corroborating data have been located. In this catalog (253) we read, "Air gun with octagon brass barrel, stock made entirely of iron to hold air, German silver mountings, wooden ramrod, flintlock hammer on side drops down and strikes lever to release air, barrel 34 inches, 50 inches overall. Made as a model for the Continental army by Peter Ballou, (made the first State House Clock.)"

Realizing the peculiarities encountered in the descriptions of air guns in the past, the "Ballou" air gun could be anything, beginning with something similar to the unmarked pneumatics and passing through the development up to types which we date around 1820.

As regards this maker, it is possible that the compiler of the above catalog misspelled and confused the name and date. A Peter Pelaix was working as a gunsmith in Philadelphia in 1816 and, under the name of Peloux, in 1829. He is identified as a maker of flint-lock rifles similar to the model 1819 (104, p. 699).

The most interesting series of references to the use of air guns in this country during the last century occurs in the Original Journal of the Lewis and Clark

Expedition, in which there are seventeen entries specifically referring to air guns (153). One note identifies Captain Lewis' air gun; another states . . . "we shot the air guns . . ." The balance of the entries refer to either "my" or "the" air gun, and note the amazement of Indian observers, particularly over the killing of a deer with the gun. "Forty shots with one load" is stated in an editor's footnote, and, in another place reference appears to be made to the bellows of the captain's gun. Actually, the note regarding the bellows, while apparently referring to the gun in context, may mean the blacksmith's bellows, which also attracted considerable attention.

There is no descriptive matter available regarding the mechanism of the weapon; in all probability none was deemed necessary. Inasmuch as the expedition extended from 1804 to 1806, it is reasonable to conjecture that either a ball-reservoir or a butt-reservoir air gun is meant.

Several repairs were needed during the course of the trip, springs seeming to give some trouble. The references, however, extend rather uniformly through the seven volumes, and no disparaging remarks are included. Presumably the weapon or weapons functioned very well.

AIR GUN LAWS

It is curious to note that one very frequently encounters references to laws regulating air guns. Francis Bannerman in his catalogs from 1907 to as late as 1925 (11) states, ". . . as air guns were prohibited in olden times in Oriental countries, who feared the silent bullet." This statement has become one of the traditions in America, although its source has been generally forgotten, if ever it was known to those who still quote it. Not only is the law cited, but the "oriental" angle is accepted without question, in spite of the fact that to date only one reference to an oriental air gun is known, and that Japanese. The piece, incidentally, which Bannerman illustrated in connection with this remark, is an Austrian type with the Girardoni breech.

Auguste Demmin, in his brief remarks on air guns (58, p. 556), states that the air gun was forbidden in France. The *Dictionnaire Universel Des Sciences, Des Lettres, et Des Arts* (66), discussing air guns from the French point of view, also refers to the prohibition. Pollard (186, p. 122) says, "The air-pistol has been known since a remote period, and was sternly forbidden as a weapon during the earliest days of firearms." Feldhaus (79) puts the matter succinctly where he says, "In guerilla warfare the air-gun was a priceless weapon. As a result Napoleon, in his wars against Austria, caused every person who carried an air-gun to be summarily shot or hanged. If this gun had not accomplished much, the corps certainly would have not come under this mass regulation." Maleyka (163, p. 5) includes a small section entitled "Air Guns Partially Forbidden," which contains the following remarks:

"The introduction of air guns was not universal. This is probably due to the

fact that the relatively silent gun could easily be employed for improper purposes. It was forbidden in various states.

"Hanns Friedrich von Fleming writes in his complete *Teutschen Jäger* (Leipzig, 1724) page 318 (under another title) 'The air guns are very dangerous and nobody is allowed to use them except officials.'"

We cannot, however, discount the matter of assassination with an air gun as sheer nonsense, inasmuch as there is a record of an attempt on the life of Oliver Cromwell with such a weapon. J. N. George (89, p. 29) gives interesting information relative to this matter and says, "After the collapse of the attempted rising of 1664, the plots of the Royalist Party against the Commonwealth took a fresh form, aiming at the assassination of Cromwell rather than at a general rising, which was felt to be hopeless as long as he lived. . . . Mr. Secretary Thurloe . . . was . . . kept well informed with particulars of the various plots in progress.

"Nevertheless, the conspirators devoted much ingenuity to planning the destruction of the Protector, to which end they purchased a surprising variety of weapons and explosives, including a powerful air-gun, guaranteed to kill at 150 paces . . ."

This glimpse at attempted assassination is enlarged for us by F. C. Bewsey (25), who sent the following excerpt from a letter in the "Thurloe's State Papers," (1742 edition, dated 12th November, 1655).

". . . I feare that C. S. (Charles Stewart) his instruments have bin dealing with major William Cromwell, and that some designe is plotting to kill the Protector; for besides what I gather at the former discourse, I finde sir Joseph Wagstaff hath bought at Utrecht a gunne, which shewts with wynde only a bullet a 150 paces, and that 7 times one after another, with one charging with wynde. It makes no report, or little smoake comes out of it; so 'tis difficult to discerne, whence the shot comes. I am well inform'd, this gunne is to be sent for England, wheare I am suer none knows how to use it, but he that carreys it over. This, I doubt, is bought for no good use; whether it will be sent or where shipped I cannot tell. . . ."

Bewsey (19) brings the business up to date in Europe. He says, "With regard to England and Germany producing spring guns, firearms restrictions are severe on rifles but do not affect airguns." In his correspondence, Bewsey identified current "air guns" of the legal variety as spring guns, not true pneumatics. As a result, modern types such as Apache, Sheridan, Crosman, etc., are restricted and subject to license.

Numerous local laws and ordinances exist in the United States regulating or forbidding air guns or any arm so classified in popular terms. These laws are rarely discriminatory. They merely include such arms, for purposes of safety, along with firearms, which are not to be used in or near cities or heavily occupied areas.

Air Guns versus Firearms

When one considers the advantages of the air gun, it is also necessary to review the disadvantages of the firearm, particularly as they existed in the flint lock and earlier ignition systems, comparing the arms with such disadvantages and limitations with the coexistent air guns. While this may presuppose its superiority, the air gun did have certain objectional features that apparently prevented it from ever being taken up seriously by many nations.

The first and most obvious disadvantage of the firearm was the uncertainty of ignition, in which respect the air gun had a decided advantage. The flint-lock, wheel lock, and matchlock were in a state of constant struggle with the elements, and hunting with them was essentially a fair-weather sport. Likewise, bad weather could upset military tactics, and in the matchlock era the ambush as well as the stalking of game was practically impossible.

As far as certainty of ignition, i.e., discharge operation, is concerned, the air gun never misses fire except under circumstances of structural failure. In the thousands of experimental shots discharged with numerous pneumatic guns we have never experienced a failure due to this cause. We have had our troubles with the air gun but this was not one of them.

Experience with early ignition systems reveals that misfires are not at all unusual. Matchlocks miss fire because of a number of reasons. The powder in the open pan may fall out if the arm is not held correctly. If it is correctly held, a gust of wind may blow out an essential part of the priming. If the primer does stay in the pan, it may not be sufficiently fine to take fire readily and thus ignition is further delayed. Presume that it does ignite on schedule; the flame may not penetrate through the touch hole because of several causes. The vent may be fouled so badly by previous shots that ignition is impossible. Further, even granting a clean passage, there may not be any primer in it to communicate the flame, or the flame does not penetrate for another reason. If the primer does ignite and the flame does penetrate to the charge in the chamber, ignition should normally occur, unless a spoiled powder is in the gun. This latter can be discounted if desired, but the ignition of the arm, in the final analysis, is not absolutely positive.

In the matchlock the uncertainty of the match itself is a deterring feature. The wheel lock is more positive, producing, as it does, a shower of sparks within the priming pan itself. In the case of the flint-lock, fouling of the flint, or a poor striking edge, can prevent a sufficiently plentiful supply of sparks such as result from the forceable contact of flint and frizzen. Thus, as we have repeatedly experienced, the hammer may fall without having the primer ignite at all or, as has occurred only too often under particularly embarrassing circumstances, the primer may ignite satisfactorily but the chamber charge remain untouched. Hence the expression, "just a flash in the pan." Ideally, the flint-lock may be considered very satisfactory, but needs a reasonable amount of attention to maintain that condition.

While the sound of the explosion was an important psychological factor in the early use of firearms, and for many years one of its most effective features, after the novelty wore off and it was found that the noise itself did not hurt, it began to have its very evident disadvantages. The thought of a silent bullet was so disconcerting at times that it became the subject of some conjecture.

Hime (120, p. 167) notes the following: "Throughout the whole gunpowder period, enthusiasts were never wanting who believed in the possibility of making smokeless powder and noiseless powder. . . . The belief in a noiseless powder was scoffed at by Whitehorne: 'There be many who bring up lies, saying that they can tell how to make powder that shooting in gunnes shall make no noise, the which is impossible.' A century afterwards Sir Thomas Browne believed that means might be adopted 'to abate the vigour thereof, or silence its bombulation.'"

An example of the effect of the silent bullet occurs in Thornton's "Sporting Tour Through France," Vol. 2, p. 59 (24). "One day in particular, General Mortier, in speaking of air-guns, recalled to the recollection of some officers in company, a circumstance which happened after the retreat of the enemy, but where I cannot precisely call to mind. He said, 'do you not remember when I ordered the cannon to cease firing that an orderly sergeant who was standing close to us, leaped very high in the air and then fell down? We supposed, at first, that he was in a fit, and we were greatly astonished to find him dead, as nothing had been seen or heard to injure him. On his being undressed, however, a ball was found to have struck him, which must have been shot from an air-gun in the adjoining field, and aimed at some of us.' 'Yes,' replied one of the officers, 'I remember it very well, and I think we had a fortunate escape.'

"They then stated that on account of this treachery they hung up all of that corps that fell into their hands, considering them not as soldiers but as assassins, and never gave them any quarter.

"They acknowledged, at the same time, that they lost many fine men by that Corps of Austrians, which they stated to consist of about five hundred men."

The attitude of the officers in this report is quite understandable. While they were incensed at the use of the silent bullet against them, one wonders how they would have felt had they been the owners of such weapons or had they had such issued for use. In any event, there is no question regarding their interest in the air gun, objectionable though they may have considered it from a military standpoint. A certain element of tradition may have influenced them also, a tradition of noise and smoke, which would have prejudiced them against the, to them, new, horrible, and unsoldierly weapon. To the Austrians the air gun was quite satisfactory and, except for certain problems which we will discuss later, a reasonable arm to employ in war. It appears, however, that the scruples of certain of the gentlemen were ultimately removed, inasmuch as Thorton also includes notes on the use of the air gun for hunting, in which connection he speaks of it in glowing terms (see p. 21 *et seq.*).

Another circumstance in which the elimination of noise was desirable was in

hunting, as the relative silence of discharge often gave the hunter several shots at the same animal or flock. The same argument is still used by archery enthusiasts.

Air guns have also been considered a poacher's weapon because of the obvious desirability of a noiseless discharge. However, in this connection Payne-Gallwey (183, p. 308) says, "These rascals nowadays generally use common guns, though air guns are not altogether discarded, notwithstanding that they make nearly as loud a crack as a lightly-charged firearm, and are not half so effective."

The disturbing thought of the assassin who could kill in silence over a considerable range appears to have been responsible for at least some of the anti-air-gun legislation of the past.

It is not a question of the ethics involved in these matters which is of interest here. It is simply a recognition that the silent bullet which could only be discharged by an air gun did have advantages which had to be considered. (It appears that the bullet-shooting cross-bow never attained the efficiency of the air gun, was clumsy to handle, and was difficult to prepare for shooting.)

While several moderately successful repeating mechanisms were produced for firearms of the pre-cartridge period, the inherent limitations and incidental dangers of bulk gunpowder made the single-shot arm the safest and most efficient one to use. With the air gun an assortment of principles has been available, the specific designs of which were optional. They are:

Single pressure charge, single shot.

Single pressure charge, multiple shot (with bullet magazine).

Multiple pressure charge, single shot.

Multiple pressure charge, multiple shot.

One material advantage which the air gun therefore possessed over the firearm was the fact that the former adapted itself to rapid fire and repeating mechanisms more readily than did any of the firearms of the pre-cartridge era. The repeating flint-lock was very much the exception, while in the air gun of the 19th and earlier centuries the repeating arm was the rule and the single shot pneumatic gun, in which one shot depleted the reservoir, was, according to presently available data, almost unknown.

An interesting illustration of the problem of designing repeating mechanisms for the flint lock as against air guns of the period is the case which Thierbach, quoting Dolleczek, recites of Girardoni (288, appendix, p. 24), who originally applied his repeating mechanism to the flint lock. While demonstrating his presumed improvement, the magazine of the gun caught fire, exploded, and took off its inventor's left hand. When he recovered, Girardoni took that portion of his weapon which handled the ball and applied it to an air gun. This formed the basis for the Austrian repeating air rifle, model 1780, which will be discussed later.

Flash-over and fouling were the two major difficulties to overcome in design-

ing a safe flint lock repeater. No matter how careful the fitting there was always the danger of the flash from the chamber communicating with the powder magazine, or the powder channel which led to it, and prematurely igniting the entire amount of the bulk powder in that container. The same thing has been known to happen during the percussion revolver era, as many modern users of Colt and Remington cap revolvers can testify. One of the early patents granted to Leavett (151) calls for cutting the forward surface of the chambered cylinder at an angle to serve as a flash deflector. Flash-overs obviously did not occur in the repeating air gun.

A very practical advantage which the air gun possessed over the firearm (considering the use of the older explosives, not the modern non-fouling compounds) is the fact that the air gun needs almost no cleaning, while the firearm requires cleaning after every use or it suffers a rapid deterioration. The only fouling which can affect the air gun is that which results from handling, or from the possible condensation of moisture in the bore due to the cooling effect of the suddenly released air from a reservoir. Lead fouling in the bore may cover such moisture and allow corrosion, and, admittedly, the leading itself is conducive to a certain inaccuracy in shooting. However, the great problem of chemical foulding which normally results from the use of gunpowder, is eliminated entirely. Because of an absence of fouling, the use of rifling in an air gun presents less of a problem than it does in a firearm. It is interesting to note that air guns, even very old ones, almost invariably are found with well-nigh perfect bores.

Rapid-fire in a muzzle-loading rifle has a very serious danger involved, due to residual sparks in the coked-up chamber which could, and too often did, ignite the succeeding charge. Modern muzzle-loaders would do well to keep this in mind. The air gun, naturally, had a material advantage in this matter in that only the ball needed to be handled, instead of also powder which had to be bought, transported, and measured, constantly in an atmosphere of danger. The propellant for the air gun, the air, was everywhere present and untaxed. The problem of getting saltpeter, the primary ingredient of gunpowder, was a very real one, and in instances the control of this commodity became a government monopoly.

In the air gun the principle of breech-loading also has been the rule rather than the exception as in the firearm. The seal of the breech and the strength of the structural parts was of less importance in the air gun. One type of breech, found only on air guns, actually uses the flexing of the wooden forestock as the hinge, and all that holds the barrel and receiver together is the strength of the light, flexible forestock itself. In many other cases the barrel is really separate from the receiver, a juxtaposition of the air port in the receiver and the breech end of the barrel being the only union present.

From the standpoint of efficiency it is acknowledged that the pressure of the air in the reservoir of a true pneumatic arm is progressively lowered by succeeding shots, but in our experiments we have found that, for example, the strength between the first and tenth shots is practically the same. The pre-

sumed drop in efficiency is really negligible. By comparison, in the case of gunpowder the strength of several batches may vary from day to day due either to modifications in composition or atmospheric humidity, in instances considerably. Up to the time of the invention of corned powder, first mentioned in 1429 (120, p. 154), and for quite some time thereafter, it was customary to mix the ingredients at the time of firing in an attempt to be sure of complete incorporation and to avoid the separation of the components while traveling. For a century and a half thereafter serpentine, or mixed-ingredient powder, continued in use. With the production of powders of rather standard strengths, this problem of variation was minimized, but the existence of powder testers of rather recent manufacture indicates that the problem still remained at that time.

There is a possibility that the air gun may have been used as a shotgun in shooting flying game before the coexistent flint-lock because of the fact that the air gun does not have the disturbing flash in the pan and the slowness of ignition, which would make the shooting of running or flying game with a pneumatic weapon a practical thing. While its effects can be minimized by deliberate practice, the disturbing flash in the pan is quite conducive to flinching, a habit difficult to correct when once established.

From a military standpoint the smoke of firing was a decided disadvantage because it revealed the position of the shooter and, in the case of volley firing as was formerly considered excellent tactics, the smoke obscured the vision sufficiently to make successive shots ineffective. History reveals instances in which battlefields were so befogged with smoke that it was necessary to cease activity until the wind could clear the smoke away, or else change troop positions. This was one of the reasons Franklin gave for suggesting the adoption of the long bow for the army (82). From this standpoint the air gun was ideally situated and, in one recorded case at least, was used as a sniper's rifle.

Another claimed advantage of the air gun lay in the amount of ammunition which could be carried. The sportsman or soldier going into the field could carry sufficient compressed air in the reservoir of his gun for possibly forty shots (the latter diminished in power) and could, if he wished, carry extra reservoirs. In certain cases there would be a questionable advantage because of the weight of the reservoir, which would be greater than the weight of the powder needed for a similar number of shots. In the Austrian military rifle with the removable butt reservoir it would be considerably more.

An Austrian marksman equipped with the air rifle went into battle carrying twenty-four filled flask reservoirs (79), each of which held a potential of upwards of twenty shots. It is said that if the reservoirs carried were not sufficient, replacements were available from wagons which brought up the rear. This implies an emplacement similar to that used by a modern machine gunner, with similar effectiveness. With normal equipment, therefore, the soldier was prepared to deliver at least 480 shots at a range varying from 150 to 400 paces. This means that one corps of 500 men, such as mentioned in the Thornton report, could deliver 240,000 shots with normal field equipment. The rate of fire of the

Girardoni (Austrian) rifle was twenty shots per minute, according to Feldhaus. Further, one reservoir could last for at least a minute, and the twenty-four, allowing for replacement time, would keep the soldier busy with his gun for at least a half hour. On the basis of the corps of 500 men, there was a potential fire power of 10,000 shots per minute, or 300,000 shots in a half hour, at which time replacement reservoirs would be needed. This, in view of the material weights involved and the then existing rates of fire, is absolutely fantastic. It is no wonder that Napoleon ordered the death of any and all Austrians caught with air guns. If Feldhaus' claim that a corps consisted of 1313 men is true, these figures are less than half of what would appear to have been possible.

It must not be forgotten that these weapons did not heat up due to rapid fire. In fact, the more rapidly discharged, the cooler a pneumatic gun is, due to the chilling effect of air or gas when suddenly released from confinement under pressure.

The disadvantages of the air gun are of a very fundamental nature. Primary is the cold, hard matter of cost. The construction of the weapon required practically every element present in a firearm plus the addition of certain parts. The first of these was the reservoir for the compressed air. This necessitated the forming and welding of an air-tight container which had to be fitted with a screw joint. In addition to the reservoir a valve assembly was required. This consisted of a thread to screw on to the gun, a thread to screw on to the reservoir, a thread to hold the valve housing, and a valve seat. The latter had to be fitted with sufficient precision to permit the retention of air under a pressure of 500 pounds or more per square inch. In our experiments we used 750 pounds, gauge measured, of carbon dioxide from a tank.

The fitting of the horn valve to the cup-shaped seat required a precision of workmanship far above that needed in fitting firearm parts. Even after these extra operations were completed, there remained the business of making a pump for charging the reservoir. This amounted to a task at least equal to that required to make a barrel, plus the additional requirement that the internal surface or bore be fitted with sufficient precision to allow a steel piston to make a slip fit within it, the pump chamber. It also required the cutting of at least one more thread.

For its most practical utilization the air gun also required a breech of some kind, involving other operations. At the very least, it may be said that the air gun required twice the time needed to produce a firearm of similar quality and workmanship. The air guns upon which the Austrians apparently put such hope were eventually abandoned because of the state of disrepair into which they had fallen. The techniques of manufacture are claimed to have been kept secret (79), and a few men, in secret locations, were trained in the needed specialties to produce these arms. It not being a matter of common knowledge, and therefore subject to private experimentation, development, and exploitation, the Austrian military air gun, at least, fell by the wayside, although forms of it did survive for a time as sporting arms.

Our experience in air guns (reservoir types) has been that the fitting of the

valve to its seat requires a degree of workmanship and mechanical skill not to be found in the average gunsmith of today. As an experiment, an old air gun was given to a skilled mechanic of our acquaintance whose skill, incidentally, is sufficient to permit him to construct his own precision measuring instruments. He succeeded in putting the gun into excellent operating order but never did develop his valve to the point where it would hold pressure for more than a day.

An air gun in good condition and properly fitted should hold pressures indefinitely, and one record is in existence of an air gun which had been put away for sixteen years between discharges. Our friendly collaborator, F. C. Bewsey, who quotes the above, had set aside such a weapon for several years, during which time he was in military service. This gun has been discharged but once since Mr. Bewsey's return and has been retired, in an attempt to beat the sixteen year record (20).

Aside from the actual maintenance of the valve, there is a considerable problem involved in the primary fitting, as, for instance, the relatively simple operation of properly aligning the stock or ball reservoir with the rest of the arm. This might appear to be a minor matter until the components get out of adjustment. The amount of protrusion of the valve stem itself is a matter requiring fine fitting, as is that of the striker rod which opens the valve. The safety feature on an air gun, consisting principally of a mechanical trip rendering the striker inoperative, is an additional item of expense.

From the number of air guns which have been available to us which are finely fitted and cased, in some instances accompanied by complete sets of spare working parts, we have rather come to the conclusion that the air gun, in one part of its life at least, was a novelty used by people of wealth who had sufficient funds to go in for the unusual. One set came equipped with three extra valves, valve stems, and springs. What poacher could afford such an arm?

Another disadvantage of the air gun was the physical work required to charge it. The pump accompanying a British air rifle (129) is marked: "800 STROKES TO FILL EACH GLOBE WITH AIR." Even a single charging, accounting for a day's shooting of twenty or more shots, obviously required a great amount of effort. While this would not be an important consideration to a man with servants who could perform such a task, it would certainly be an exhausting matter to a sportsman unless done a day or so previous to a hunt.

An additional item of a negative nature is the element of danger involved in having air under compression. There are several instances of air gun reservoirs having exploded, and one specimen by Bouillet in the Harrison Collection has a piece of metal, approximately two inches long and a half inch wide, welded on the reservoir, apparently as a repair.

One incident which is often recited regarding the great dangers accompanying the air gun is the occurrence that happened to a Mr. Tyssen of Donyland Park, Essex (20). It appears that the gentleman had a servant pumping air into a reservoir when suddenly the reservoir and pump parted company and the former,

passing upward through the trees, cut off considerable branches. Misquotations have come to our attention greatly enlarging upon this occurrence which, while not specific, give the impression that there was a signal disaster at Donyland Park, even possibly the explosion of an air gun, which reports could be gun-makers' propaganda to discredit the arm.

For some unknown reason the ball-reservoir has been considered less safe than the butt-reservoir type. We have had some speculation with Mr. Bewsey as to the causes of the reported and evident explosions, and have considered the possibility of oil having worked into the reservoirs and causing a diesel-type explosion under the heavy compression of air present therein. We have avoided potential trouble from this source by using compressed carbon dioxide.

E. M. Reilly (200, p. 11) adds to this some interesting comments in his sales brochure, which is dated 1850. Referring to machine pumps, he says, "The pumping machine, when turned very rapidly, often produces singular effects which cannot arise from friction alone. I have seen the metal reduced to nearly a blue colour smoking with the heat, the horn part of the valve parched up, and have often been inclined to credit the saying of the workmen that the air takes fire."

As an example of the element of cost serving to keep the air gun from ever having become an arm of the average person, we must consider the wheel lock. In its early days the only advantage that seems to have existed in a flint-lock was the matter of cost. As far as certainty of ignition was concerned, the wheel lock was superior to the flint. This has been corroborated by experiments with both ignition systems.

A minor disadvantage of the air gun is the fact that the reservoir, used either as a ball or as a butt, must have been unpleasant to handle in cold weather. This was obviated to some extent by covering the stock with leather or cloth, and in some cases making a stocking-cap arrangement over the ball reservoir.

The early workers must have had a considerable fear of reservoirs exploding, as is indicated by their examples having been almost invariably made of copper. Later they were made of bronze, and last of iron or steel. While the softer metal does not have the tensile strength of iron or steel, it does have the advantage of opening when it gives way and does not fracture or splinter like a grenade.

An air reservoir which has been filled to its critical pressure in a cool room will, of course, increase its pressure and possibly explode when brought out into the warm sunshine. We have wondered, in this connection, what the fatigue element would be under the constant shock waves induced by the periodic opening and sudden closing of the valve against pressure, but conversation with diesel engineers has assured us that under normal use the fatigue element would not be present.

Distribution of air guns is limited by another factor somewhat related to previous remarks. The skill required to maintain the valve and certain other parts of an air gun would make it an impractical weapon for use at any distance from the gun making centers. For this reason its use, for instance, as a frontier

weapon, would be largely out of the question. Use under such conditions would require considerable technical ability on the part of the shooter. The outstanding exception appears to be the employment of the air gun in the Lewis and Clark Expedition previously mentioned.

The Blow Gun

"It shoots with marvelous force," says Leonardo da Vinci (55, p. 816), discussing his presumed blow gun. This might be an unexpected remark to come from so learned a man who was familiar with the bombards of his day, with the bows and crossbows then in use and, as a student of arms, familiar with the traditions of such things as Archimedes' steam gun and other engines of the ancients. Indeed, it may be assumed that it took quite something to surprise da Vinci.

The effects of the blow gun invariably produce a gasp of amazement when the weapon is demonstrated before a group. After a casual acknowledgment of what a blow gun is, the thud of the projectile on the target produces what da Vinci called a marvel. This is particularly true if the observers are familiar with the ballistics of firearms, realize the enormous pressure produced by burning gunpowder, and know the meaning of impact.

This weapon has for so long a time been associated with primitive cultures that it came as a distinct shock to find that our early speculations regarding the possible existence of European blow guns as fore-runners of air guns were verified, not by deduction, but by the existence of actual specimens and medieval illustrations, all of which will be later presented.

The blow gun is a very simple device. It consists of a tube through which, by the shooter's breath, a small projectile is discharged. The tube may be constructed in several ways and the projectiles may vary from simple darts or clay balls to elaborately fabricated pieces which in instances remind one of badminton shuttlecocks.

Primitive blow guns are found widely dispersed throughout the world (Fig. 13) and may be independent inventions in most places, although one could argue that point at length. They are noticeably absent in the boreal regions. Rather near at hand are those of the Cherokee Indians of south-eastern United States. It is also found along the headwaters and tributaries of the Amazon and Orinoco rivers of South America, as well as in and around Mexico, and among the natives of Borneo and adjacent areas. In many places the blow gun, either because of degeneration or lack of development, is considered merely a toy for children. While at first glance the various examples from their several sources would appear to be almost identical, there are differences in structure and technique of manufacture which could indicate decided individuality in origin.

Three basic methods appear to have been used to produce the primitive blow gun: one, that of drilling out a shaft; another, the enlarging of a soft or hollow

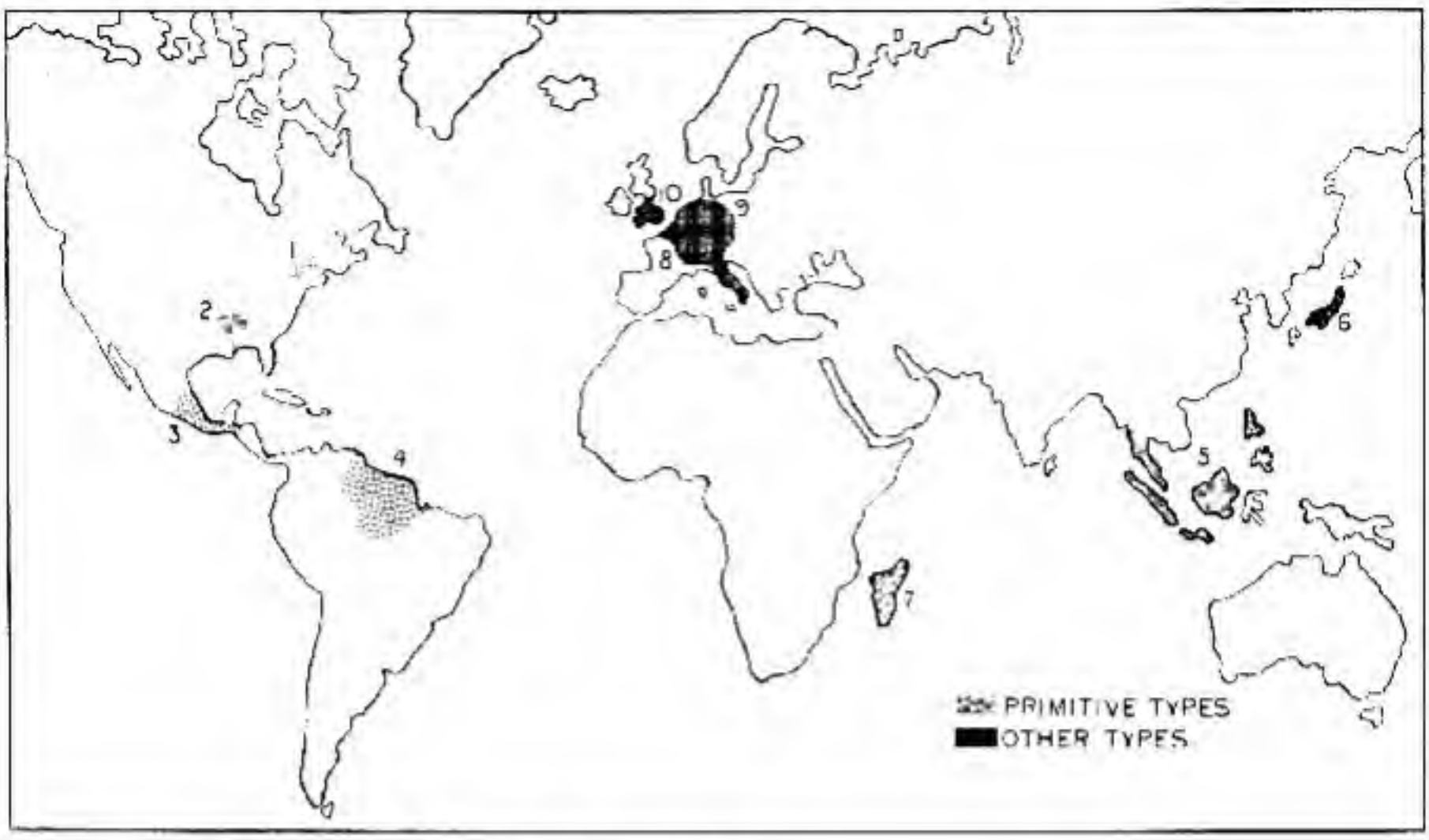

Fig. 13. Blow Gun Distribution.

America: 1. Iroquois.
2. Cherokee and Muskhogean tribes.
3. Mexico and Central America.
4. Amazon and Orinoco rivers tribes.

Asia: 5. East Indies and Siam.
6. Japan.

Africa: 7. Madagascar.

Europe: 8. Medieval and Renaissance Europe.
9. Germany, 18th century.
10. England, c. 1876.

center of a cane or similar growth; and third, splitting a chosen billet, cutting a primary groove in it and then, after reuniting the halves, enlarging the pilot hole to the desired caliber.

According to William Henry Furness (86, p. 113), the best blow guns of the Borneo head hunters are made of a hard, close-grained, reddish wood, which is not only exceedingly straight but has very few knots. A staff of wood about eight feet long is dressed to a uniform diameter of about three and one-half inches. This staff is inserted into a hole in the platform floor of the house and one operator guides the drill while another does the actual drilling. A slender iron rod, with a roughened, flattened bit, is worked up and down, gradually producing the desired bore in the billet. The rough boring takes about eight or nine hours. Furness does not give more details about this primary operation, nor does he clearly state whether a turn-drilling technique is employed or whether a straight, reciprocating motion alone is used, but in either case, it can be visualized as similar to drilling a well. It appears that the grain of the wood prevents the drill from deviating from center, an almost unbelievable matter to anybody who ever tried to drill a concentric hole in a long piece of stock.

Continuing with the report, an abrasive is next applied to a rattan lap, and the bore enlarged to the desired caliber. "It is thus polished until it shines almost

as brilliantly as a gun-barrel." Subsequently the outside is dressed to the desired size.

"Some of the more highly finished blow-pipes are furnished with a sight . . . made of a cowrie shell imbedded in gutta-percha near the muzzle . . . others have an iron sight, near the muzzle, bound on with rattan."

I. H. N. Evans (76, p. 191) states more briefly that the Bornean blow gun consists of a cylindrical tube of hard wood, the muzzle end of which is fitted with a small wooden sight above and with a flat spear blade below which is said to serve as a guide to the dart, but can also be used as a weapon.

He also mentions the short dart with poisoned tip and conical head of pith which fits the bore of the tube. "In discharging the dart from the blow-pipe the weapon is not held like a gun as might be expected, but is gripped with both hands close to the mouth-piece, the knuckles being upward." This grip will be observed in most of the illustrations of primitives shooting their blow guns.

Dr. Ralph Linton (157) discusses the blow guns of the Tanala, a hill tribe of Madagascar, and identifies their weapons as being either a form of cane or a species of palm. In both cases a short rod is heated red-hot and passed through the material, in the case of cane to burn out the joints, in the case of palm to actually produce a hole. The cane guns are rarely over three-quarters inch in diameter and are ten to twelve feet long. The wooden (palm) tubes are thicker and shorter, but never over one and one-quarter inches in diameter. No mouthpieces are applied, but on occasion rawhide rings, made by drawing on sections of the skin from a cow's tail, are slipped on while wet and serve as reinforcements where needed.

Splinters of bamboo, ten to eleven inches long, fletched by wrapping on a vegetable floss, serve as ammunition. Poison is indicated but appears to be more magical than actual.

The blow gun was an important weapon in ancient times. It was rarely employed in open battle, but was effective in the defense of villages and for sniping from ambush. It is still in constant use for hunting lemurs and other small game, and few households are without one.

Lewis V. Cummings (52, note 20) gives detailed information regarding the construction of a blow gun by South American Indians on a tributary of the Orinoco River. He claims that the South American Indians, while not the only ones to use the blow gun, have brought it to the greatest point of development. He says that in their hands it is the best weapon the world has ever known for small and medium-sized game (Fig. 14).

This type of blow gun is made from the stem of a thin-walled species of palm, the pithy core of which is pushed out with a hardwood rod, preparatory to sizing the bore. As in the previously mentioned Bornean tube, the smoothing and polishing is done with abrasive laps.

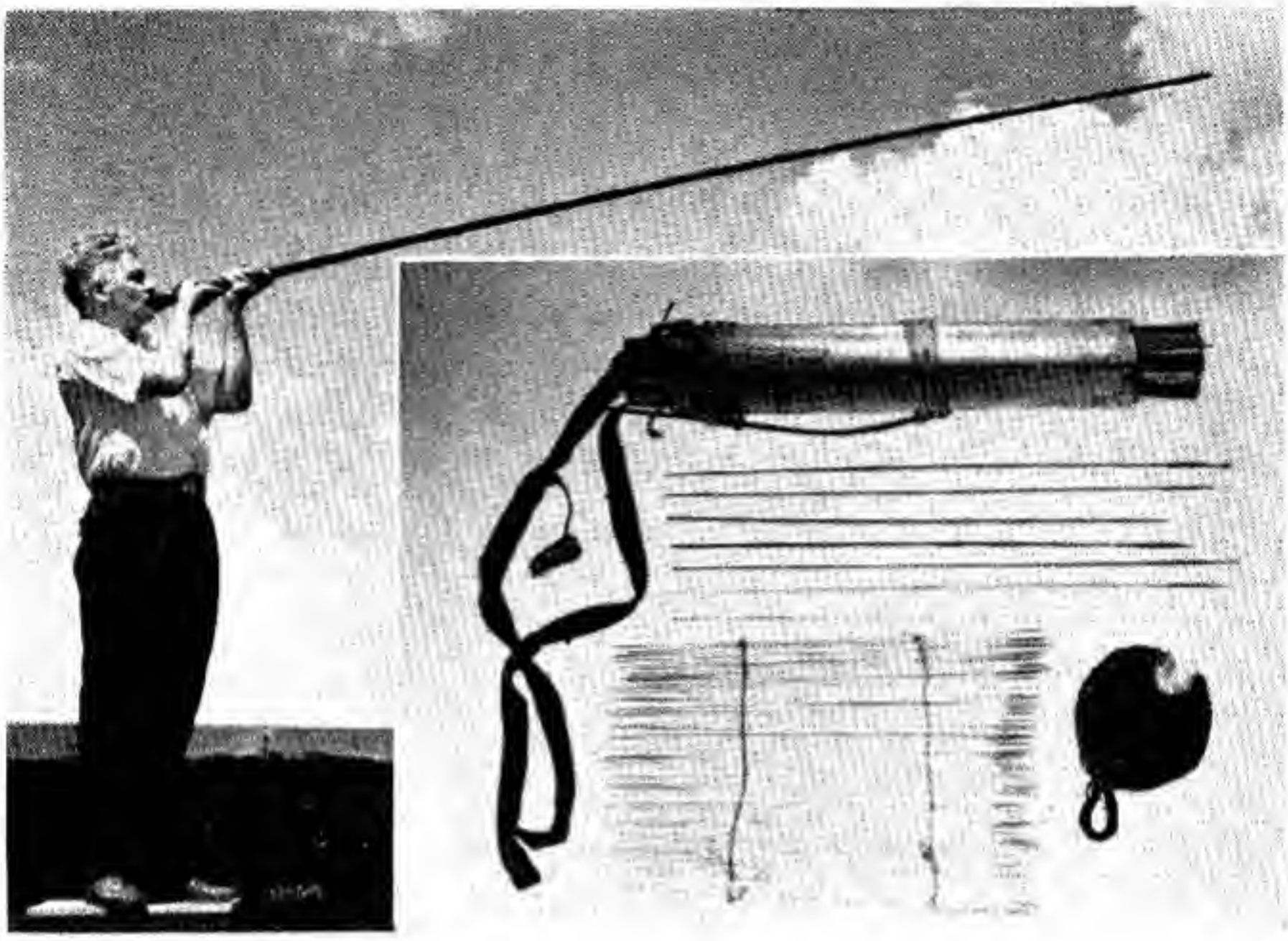

Fig. 14. The Primitive Blow Gun.
The Jivaro-type blow gun in shooting position. Insert: quiver, darts, cotton, and cutter. The quiver is a section of cane filled with a loosely woven pad of grass into which darts may be slipped. The darts appear to be sections of cane dipped into a brownish poison. Previous to shooting at monkeys, the tip end of a dart is partly cut through by means of the piranha jaw which hangs from the carrying belt of the quiver. The cotton fletching for the dart is carried in the knitted ball.
(Negs. 202924, 426988)

Two tubes are thus prepared, one to slide within the other for strength. They are held together with a gum and, being doubled in wall thickness, are quite strong. After bringing the outer diameter to the desired size, a mouthpiece is added and the weapon is finished. This type is approximately nine feet in length.

In addition to a very light dart for small birds and animals, a heavier one is used for hunting. This is weakened by scoring a groove around it, about an inch from the tip, and is then dipped in poison. Upon striking and penetrating the victim, the weakened, poisoned tip breaks off, stays in the wound and, within a few minutes, causes death. The penetration is seldom more than an inch. Instead of fletching, a wad of tree cotton is wound around the dart to seal the bore during discharge, and also to give the dart balance in flight. "Expelled by a sharp puff of the breath, the dart flies with surprising velocity and accuracy."

Bob Becker (14), in his interesting article on Cherokee Indian blow guns, states that these weapons are made of cane and that in some way the Indians have been able to burn out the joints in the material so that neither blemish, bump, nor rough edge can be seen in the barrels. The people who use these arms live

on a reservation in North Carolina and employ a native growth for them, finishing them to a little more than nine feet in length.

The Cherokee dart is made of a straight, thin shaft of wood about twenty-one inches in length, fletched with thistledown which is tied to the shaft in a slightly spiral fashion until about a quarter of its length is covered. The tip is sharpened to a point and a combination of penetration and impact shock serves to disable the game which is hunted. Squirrels, rabbits, doves, partridges and other small game are regularly taken by this means.

Jonathan Daniels (54) adds to this by illustrating a Cherokee blow gun team, noting that ". . . experts hit a target at 90 feet." The size of the target is not noted.

W. M. Stirling (223, pp. 80–85), in his report on the Jivaro Indians of the upper Amazon River, gives so complete a description of the native blow gun and its use that his information bears repetition here. During his investigation of the Jivaro, Stirling noted that the blow gun, now the most striking and characteristic weapon of these people, is never mentioned by the 16th century writers. This is of special interest when we observe that later writers have been particularly impressed by its occurrence and never fail to speak of it, which fact led to an investigation of early records in other regions of South America in an attempt to discover from which direction this weapon reached the Jivaro. The only instrument at all comparable that is mentioned in the 16th century is the pea-shooter or pellet gun of Mexico and Central America. The earliest reference to the true blow gun is found in the writings of Saabedra, who in 1620 described the blow gun with poisoned darts in use among certain of the eastern Indian tribes. As far as Stirling is aware no one has suggested the post-Columbian introduction of the blow gun into the South American region. It seems to him probable that the use of the blow gun and its equipment was brought into South America by southeastern Asiatics, possibly from the Philippines, who were carried across the Pacific in one or more of the many Spanish galleons that followed this route in the 16th century. These individuals, escaping into a familiar jungle environment that supplied all the necessary materials, could easily have used their knowledge to manufacture this complicated but most useful weapon. It would appear quite certain that the Jivaros did not have the blow gun until the 17th century.

The blow gun is made as follows: A suitable chonta palm is cut down and allowed to dry in the sun for about a week. The thorns are then removed from the outside of the trunk and it is split in half. From these pieces two strips, each about three inches in width, are split off and cut to the desired length for the weapon. These strips are subsequently tapered. One side of each is made flat while the other is rounded in such a fashion that when two flat sides are placed together the strips form a cylinder, which tapers from about one and one-fourth inches in diameter at one end to three-quarters of an inch at the other end.

A small, straight groove is scratched down the full length of each strip in the center of the flat side, whereupon, by means of a sharp tooth, this groove is

enlarged on each strip until the two are slightly less in diameter than the intended bore of the blow gun. They are then placed face to face with a straight, cylindrical rod of chonta wood sandwiched between, in the middle, and are tied together with bark strips. The bore is then lapped and polished with abrasives in a manner quite similar to that previously discussed. After the bore has been enlarged and polished, the touching surfaces are prepared with a native glue and are then placed together. The outside of the blow gun is then wrapped with strips of bark and smeared with glue. A bone mouthpiece is fitted over the heavy end of the tube, and two teeth imbedded in a groove about a foot from the mouthpiece, serving as sights. The author is not very clear on this point.

The length of a blow gun varies more or less. It may be said that there are two types; the short, which is approximately ten feet in length, and a longer type which may extend to fifteen feet. The longer the weapon the greater its range and accuracy. The long blow guns are generally used in hunting larger game, such as wild pigs, monkeys, and large birds which roost in high trees.

The darts are made from the midribs of the leaves of the ivory nut palm. These strips are cut into the proper length, which is measured from the base of the palm of the hand to the crook of the elbow. The strips are then split into sticks of the proper size and shaved to a point at one end, the stem of the dart having a diameter equal to that of a common match. Poison is necessary to make the dart effective, except when shooting small birds. A circular cut is made around the dart about an inch from the point so that this section will break off in the wound. This is particularly necessary when shooting monkeys, as a monkey always will attempt to pluck the dart out immediately upon being hit. The blow gun is never used in warfare. The Jivaros say that it was given them for the purpose of obtaining game. To use it against man would bring bad luck.

Harold Sterling Gladwin, in his controversial book: Men out of Asia (97), referring to the Arawaks, says, "They brought the blowgun into the eastern United States and lent it to the Iroquois. This peculiar weapon is also a valuable clue in tracing these people back to their point of departure in the Old World. Beginning in the Bay of Bengal the blowgun was known and used by peoples in Siam, Malaya, the Straits of Malacca, Melanesia, Colombia, Peru, the Amazon basin, the Antilles and the eastern United States."

While Gladwin's work has been subjected to a considerable amount of criticism, his suggestion is worthy of consideration.

In his interesting discussion of blow guns from Oaxaca, Mexico, S. Linné (156) calls attention to the former wide-spread use of the weapon there. It appears from the data presented that pellet guns were formerly very important. "Moctezuma is said to have been an expert blowgun shot and, probably assuming that Charles V shared his interest in the art, he had a dozen of beautifully decorated specimens sent to the emperor." He continues by suggesting the opinion that the blow gun might have been invented and developed independently in more than one place.

The manufacturing technique of Luis Sanchez, who ". . . is probably the last blowgun maker of the city of Oaxaca," is curious. Sanchez employs a variant of the Jivaro method, insofar as he cuts a finished groove into the surface of each half and then glues the halves together, forming the tube. The grooves, when thus placed next to each other, form the periect bore. "If they do not fit together exactly, the weapon is good-for-nothing." Sanchez has been making his guns in what approximates calibers .38 and .44. While light darts are useful for discouraging night-singing cats and dogs, as well as over-lusty roosters, pellets are the usual ammunition. With these Sanchez, after a test shot, hit a nail at a distance of 15 m. He later displayed similar accuracy at a greater range. To be taken, rabbits must be struck just behind the ears, either being killed or stunned thereby. Sanchez considered it a good achievement to accomplish this at a range of 30 m.

One is inclined, upon investigation, to wonder not only as do Stirling and Linné, regarding the origin of the blow gun in South America, but further, precisely where the weapon originated in the first place. This is particularly the case when we consider the arm in Europe. Illustrative of its use there in medieval times, a painting in a 15th century manuscript, originally from Flanders and at present in the New York Morgan Library (176), which was copied from a 14th century Italian work that treated on rural economy, includes not only a boar spear, a cranequin crossbow, and incidental fishing equipment, but also a rather well-defined blow gun (Fig. 15). No particular mention is made of the arms.

That the blow gun enjoyed reasonably wide use in Europe at a later date also is indicated by Cellini's remarks previously noted, and the casual mention of it by Leonardo da Vinci (55, p. 793), who called it an air gun. In the latter's Notebooks, he discusses "of proportion" and, as a project to be experimented with when convenient, says:

"See if there are a number of small stones of different sizes whether the heaviest goes farthest when one throws it, then try alone with the same instrument and force, and see whether it travels a greater or less distance alone than when accompanied. And whether also if the *stones* are all of the same form and weight, *like* the *ball of an air gun* (Italics are mine), and are thrown by the same force in the same time they travel the same distance."

This paragraph indicates two possible facts. First, the current and general use of the instrument with a reasonable standard of caliber can be presumed, otherwise some other comparative would have been employed. Second, the remark ". . . if the stones are . . . like the balls" indicates the use of clay projectiles, possibly of the variety suggested by the molds which Maleyka illustrates.

Further, da Vinci interested himself with the relatively simple production of a barrel for an "air gun," apparently trying to circumvent the laborious process of forge-welding and reaming an iron tube. He describes his process as follows (55, p. 816):

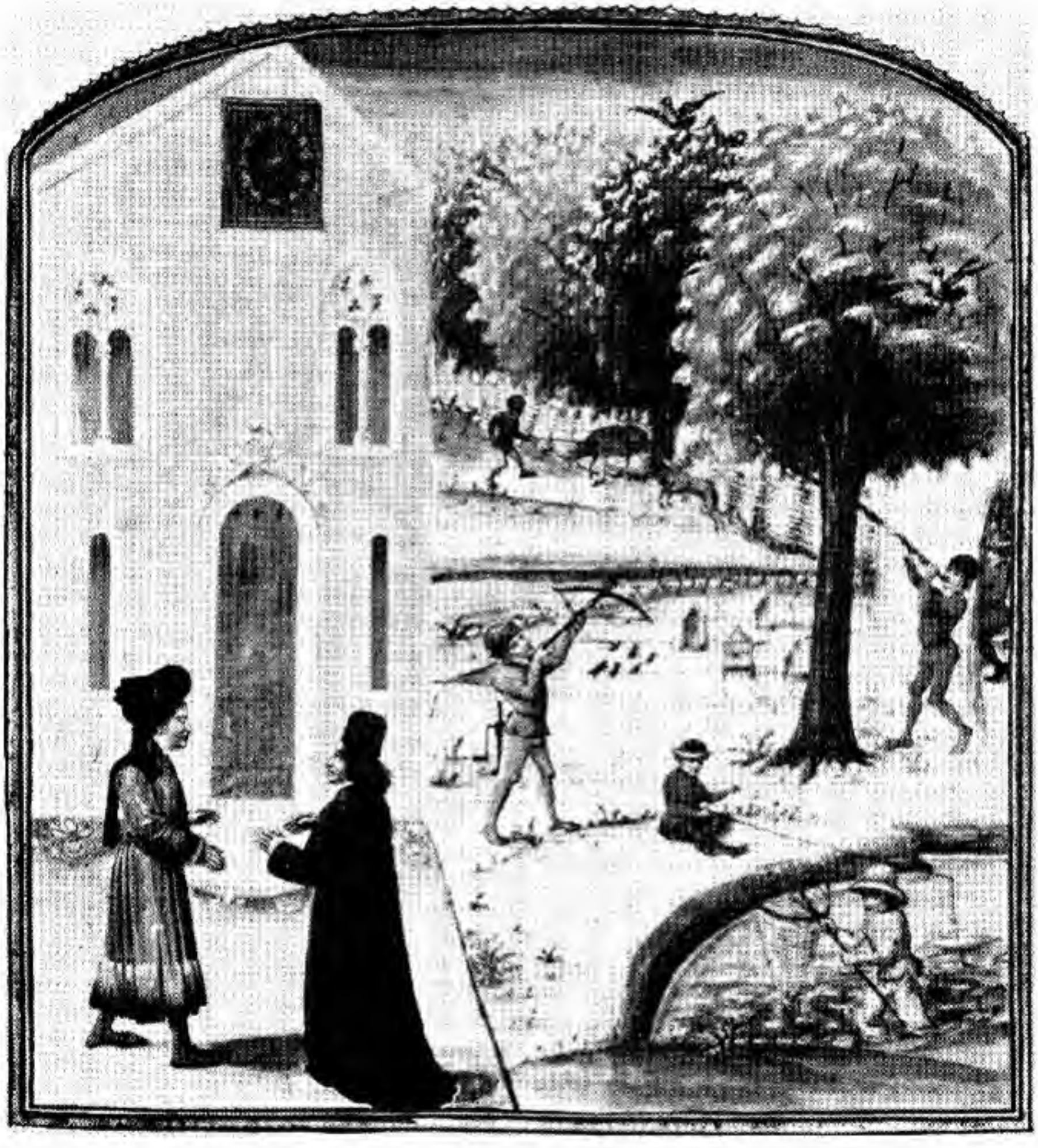

Fig. 15. The Blow Gun in Medieval Europe.
From manuscript 232 of the Pierpont Morgan Library. Courtesy of Belle da Costa Greene, Director.
(Neg. 195929)

"To make an airgun which shoots with *marvelous force* you should proceed as follows:—Stretch a steel wire the *width of a finger* on a wire-drawing machine by means of a windlass; then temper it, and beat around about it two plates of *fine copper* which you stretch on the wire-drawing machine. Then half to half solder them together with silver, *wind* thick copper *wire* about it and then smooth it with a hammer, but first solder it. And do this *three or four times* in the same way. And make it (the airgun) *two braccia* long and make it so that it can shoot a *dart* of a *third of a braccio* which is of steel." (Italics are mine.)

An analysis of these directions reveals additional items of interest. The air gun shoots with "marvelous force." When one considers the reactions on the part of observers who are unacquainted with the weapon, this statement is quite true, as was discussed previously.

Although it is not definite, the caliber of the copper barrel is suggested. Inasmuch as fingers may vary due to peculiarities of growth, heredity, or occupation, this dimension is not constant. However, it is not unreasonable to suggest something in the vicinity of about .70 inch. While this is larger than the caliber that our experiments have indicated as most desirable, it is not out of line for da Vinci's time because he could have been influenced by the firearm calibers of his day. Through the succeeding centuries the calibers of guns have been progressively reduced to the point where the antiquated dimensions appear unreasonable.

"Thick copper wire" is to be wound around the tube, presumably still on its mandril, and is beaten and smoothed with a hammer, after soldering. "Three or four" layers of such wrapping would produce a strong tube and protect the copper liner from damage. Indeed, some covering is essential inasmuch as the original tube could be very easily dented and bent.

The braccio is a variable Italian dimension, its modifications depending upon both time and specific place of use. Translated into the English system, the braccio ranges from eighteen to thirty-nine inches. Using the minimum dimension, da Vinci's blow gun was thirty-six inches in length and could have been, using the maximum, seventy-eight inches long. MacCurdy (55, p. 776) suggests a dimension of nearly two English feet, thus making the tube about four feet long.

The dart of steel is noted as being a third of a braccio in length. Again, using the variable dimension, it would be anywhere from six to thirteen inches long, and, according to MacCurdy, eight inches in length. Unfortunately, its weight and thickness are not recorded. Increased weight, while limiting the range and increasing the trajectory of the dart, would add the needed force or punch which da Vinci considered marvelous. We have found that heavier projectiles do appear to proceed with greater force, and have an impact much more severe than light darts of wood or split cane. There is, however, a limit to the weight which can be successfully employed. We have found that bessemer steel rods, one-sixteenth inch in diameter and six inches long, ground to a point and affixed into a cork or similar material of a trifle less than bore diameter, travel with considerable accuracy and almost invariably pierce the target at right angle to the surface,

indicating a satisfactory balance and no tendency to key-hole or tilt end over end. Glass marbles, and short darts made of common nails and corks, have also been tried with satisfactory results. We have not, however, attempted to use the blow gun in serious hunting.

Maleyka (163, p. 9) notes than in the 18th century blow guns of iron were made in Germany, and states that at that time they could have found use for hunting small birds. Illustrated are iron tubes with lengths ranging up to 160 cm. (about 63 inches) from the National Historical Museum of Dresden, Germany. These are accompanied by pincer-shaped bullet molds for producing clay bullets of about 13 mm. (about .50 caliber), and also leather sacks for the bullets. The presence of the sacks indicates that the balls were dried, probably baked, and were akin to marbles. Conical or shell-shaped mouthpieces are affixed to the tubes, a feature common to most blow guns. No analysis of the tube is included, so it is a matter of conjecture how they were constructed. Either a lengthwise or a spiral weld could have been employed, in keeping with the two accepted methods of forging barrels. It is improbable that da Vinci's method of producing a tube was used. There is no evidence of it other than his description. Iron being stronger, the wire-wrapping technique would have been unnecessary, except for the need of a reaming operation after forming. No ballistic data are included. Also, no mention is made, nor do the illustrations indicate whether the molds have sprue holes such as are needed when pouring bullets. For clay balls a mold need not have such holes. It could be simply a half-to-half pair of mold faces which would press the ball out of a lump of clay. The production of such a mold, while by no means an impossibility, would require techniques differing from those employed in the normal making of a common bullet mold, precision methods being needed and a product of radically different appearance resulting. The alternative would be the production of a normal mold with subsequent plugging of the sprue hole. The matter is still in doubt.

Reports of the ranges for primitive blow guns are interesting. Becker (14) states that the maximum range he has been able to attain is 118 feet, and notes that there would be no killing power in the missile at that range. This would be particularly true in his case inasmuch as no poison is used on the Cherokee dart.

Stirling (223, p. 83) states that, although the range varies in proportion to the length of the weapon, it might be said that the maximum effective range of an average blow gun is about 45 yards. This is the only reference which identifies a relationship between the length of the tube and its range. He suggests nothing regarding the accuracy of these weapons.

Becker (14) claims that one of the Cherokee Indians shot his gun at a small target five by two and one-half inches and hit it mid-center with no effort at all at a distance of forty feet. He suggests that practically all of the shooting by these people is done at a range varying between forty and fifty feet.

Furness (86, p. 177), referring to the Borneo head hunters, says that, to test their skill in marksmanship with the blow gun, a potato of about an inch and a half in diameter was fastened on a pole and from a distance of fifty paces the natives

stuck into it six darts out of ten. He adds the note that for small birds the natives seldom use darts, which cause some trouble to make; little pellets of clay are equally effective. Poisoned darts are reserved for monkeys and larger game. The natives insist that with a properly prepared dart they can kill even the formidable rhinoceros. For such large game the point of the dart is weighted with a little triangular head of bamboo or of tin, which carries more poison and thereafter becomes detached in the wound.

Cummings (52, p. 323) states that the hunting dart can be used to bring down birds or monkeys from the tallest forest trees, which often are over two hundred feet in height. Both he (52, p. 323) and Stirling (223, p. 85) note the weakening of the dart by cutting a groove around it about an inch from the tip so that the poisoned portion may remain in the wound. Undoubtedly the use of poison increases the effective range.

J. B. Scrivenor (212) adds to these reports on accuracy and notes his expenses in the investigation he conducted. A Kampar Sakai man from Cameron's Highlands, Malaya, was the marksman. The target was a bit of deal-board from the lid of a box. On this was marked a two-inch "bull." The Sakai was stationed fifty feet away and was told that he would be given ten cents for every hit on the target, and twenty cents for every bull. The shoot was to be limited to ten rounds with unpoisoned darts. The record was as follows:

1—1½ inches from the bull; 2—Bull, to one side; 3—4 inches from bull; 4—1 inch from bull; 5—Bull, center; 6—4 inches from bull; 7—¼ inch from bull; 8—Missed the target; 9—1 inch from bull; 10—1½ inches from bull.

The shoot cost Scrivenor, in equivalent English currency, two shillings, 6.8 pence ($1.10 Eastern currency). He notes remembering that the darts penetrated the target sufficiently to make it difficult to pull them out without injuring them.

It is unfortunate that da Vinci did not go into the matter farther, as we would then have contemporary data for renaissance Europe as well. The fact that he did not suggests the possibility that the weapon was sufficiently common to need no more mention than information on the manufacture of a superior tube.

In addition to recognizing the possibility that the blow gun was common in Europe centuries ago, we cannot eliminate the possibility in this connection of the use of poison there. Sir Ralph Payne-Gallwey (184, p. 13) identifies the white hellbore, which in his day (1903) was known in part of the country districts of Spain as the "crossbowman's plant," and suggests the possibility of its use to poison a crossbow bolt in foreign countries, i.e., places other than England. He specifically identifies a sporting crossbow (184, p. 145) such as was used in Spain for killing deer with a poisoned bolt.

Maleyka (163, p. 9) claims that in the 18th century iron blow guns were produced in Germany, and, developing the subject no further, appears to infer that this was the end of the story in Europe. Such is far from the case, as witness

THE WALKING STICK BLOW-TUBE, —E. LANG, 22, Cockspur-street, London, begs to call attention to his recent improvements in the above Weapon and Missiles used, he having lately received some valuable hints on the subject from an elaborate description of this weapon (as used by the Macoushie Indians), by that celebrated traveller, Mr. Waterton. To this E. LANG has added his own experience, and can now offer a very powerful and accurate Weapon for destroying Vermin, Shooting Birds, &c. Besides the above, when reduced in size, forms with target one of the best of indoor amusements for ladies and gentlemen. Tube, 10s. 6d. and upwards; darts, 4s. per dozen; balls, 1s. per 100; moulds, 2s. 6d.; targets, 2s.

W JACKSON, original Blow Tube Manufacturer (with the late T. Cooper, of New Bond-street), 37, BREWER-STREET, W., is now making an improved article at 7s.; superior Ebonised and Imitation Malacca, 10s. 6d. and 12s. 6d. Blow Tubes, as described in the *Field* of May 5 and July 28, pages 365 and 81, are acknowledged the best weapons for killing small birds. W. J. has perfected an improved dart, rigid and impervious to damp, can be blown fifty yards, for killing rooks, pigeons, rabbits, &c., 4s. per dozen. Balls, 1s. per hundred; Moulds, 2s. 6d.; Targets, 2s. With target and darts it forms a pleasing source of indoor amusement. All orders promptly executed. W. J. has no connection with any other house. Beware of imitations. P.O.O. on Brewer-street, W.

THE WALKING STICK BLOW-TUBE. —CAUTION.—E. LANG, 22, Cockspur-street, London, having been the first to introduce and perfect the above-named article, is now supplying BLOW-TUBES that WILL KILL BIRDS and VERMIN to a certainty at a moderate distance. Besides answering the above purpose, the tube forms, with target, one of the most amusing of all indoor pastimes, as it can be readily used by both ladies and gentlemen.

Fig. 16. Blow Cane Advertisements.
From "Land and Water," 1867. Courtesy of L. C. Bewsey.
(Neg. 195950)

several advertisements which were published in the British periodical: Land and Water, in 1867, and sent to us by Mr. F. C. Bewsey (Fig. 16).

E. Lang, in one of the ads, begs to call attention to his recent improvements, and credits a celebrated traveler, Mr. Waterton, with valuable hints regarding the weapon as used by the Macoushie Indians.

W. Jackson claims similar qualities for his improved article and definitely disclaims any connection with any other makers, whose products are obviously inferior.

Both makers are very elaborate in the descriptions of their products and make extravagant claims about power and accuracy, both of which depend entirely upon the shooter regardless of the high quality and perfection of the equipment.

At the present writing it is not known for how long a time the British blow tubes were produced. They appear to be rather scarce at present, probably because of a low survival potential (Fig. 17).

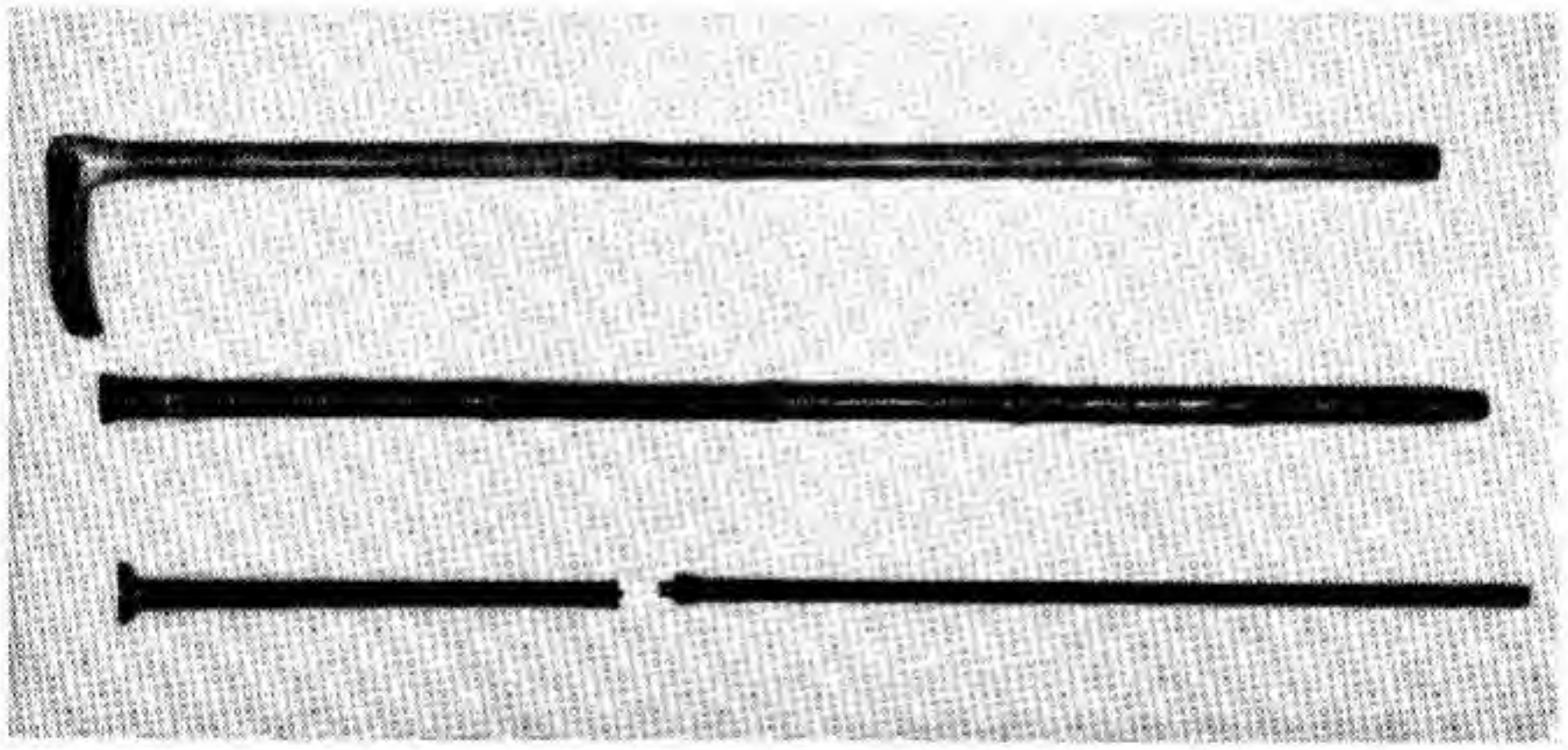

Fig. 17. European Blow Guns.
Upper: Crook handle, British.
Middle: Conical mouthpiece, British.
Lower: Cartridge blow gun. A striker in the rear section discharges a cartridge in the breech of the front portion. Origin not determined.
(Neg. 203266; middle, Nunn. No. N10867)

During the period of 1870–1910, there appears to have been used in Germany a rather short blow gun which shot what looks like pointed badminton shuttlecocks. This type was illustrated by Wilhelm Busch (39) and his American successors in many cartoons that even to this day are current.

Mr. Charles House (130) gives an account of his use of the blow gun for hunting, and brings the reports of the active use of such weapons up to date. During his stay in a European camp in the late war, Mr. House employed a blow gun for gathering hares to augment the food supply and also to satisfy the existing

desire for fresh meat. His equipment consisted of a 5/8-inch-bore brass tube and wooden darts. The latter were made of small dowels and were tipped with empty .22 caliber cartridge cases to which triangular fragments of hack saw blades were soldered.

The hares were usually hunted shortly before nightfall and were taken in a ravine where the maximum range was about sixty yards, although most of the shooting was done well within that range. One evening eight animals were taken, most of the shooting being either across or down into the gully. Relative to maximum range, Mr. House claims about one hundred yards at an elevation of approximately 35°, at which distance it is not unusual to hit a target the size of a common door.

Our personal experience with blow guns has not been as satisfactory as might be desired. Using five foot lengths of seamless aluminum conduit and sixty-grain darts of steel and paper, the maximum range attained has been 178 feet at 30° elevation. This undoubtedly can be improved with practice.

The darts were prepared from bessemer steel rods, 1/16 inch in diameter and six and one-half inches long, to which were affixed compressed paper heads, die-formed. Weights varied as much as two and three plus or minus 60 grains. Dart caliber was .600, and the projectiles fitted a bit loosely within the .620 bore tubes.

When blown against wood or similar material, the darts penetrated well and were often very difficult to withdraw. A jury-rigged test indicated that a weight of forty pounds was needed to withdraw a typical dart from a plywood board.

While we have not engaged in serious hunting with blow guns, the weapons have been tried against squirrels, the projectiles being clay balls. No animals were struck, but they voiced their displeasure at being disturbed and ultimately left the vicinity. Ranges in these instances averaged 45 feet. It is interesting to note that game appears to become aware of blow gun projectiles very readily, in spite of the traditional silence of the missile.

The Mystery of the Bellows Gun

From the standpoint of its essentials, the bellows gun is logically the earliest form of mechanical air gun, although extant specimens available to us are relatively recent.

The bellows gun is found in one inherent form which is highly developed and, in its general appearance, is reminiscent of the wheel lock. It has a hollowed-out buttstock in which the bellows and its accompanying mechanism are housed. The gun is operated by forcing the bellows open against the pressure of one or two V-springs, this being accomplished by means of a removable crank that is applied to a squared stud, normally on the right side of the stock near the butt plate. The bellows thereafter is held open by a sear mechanism and is discharged by a

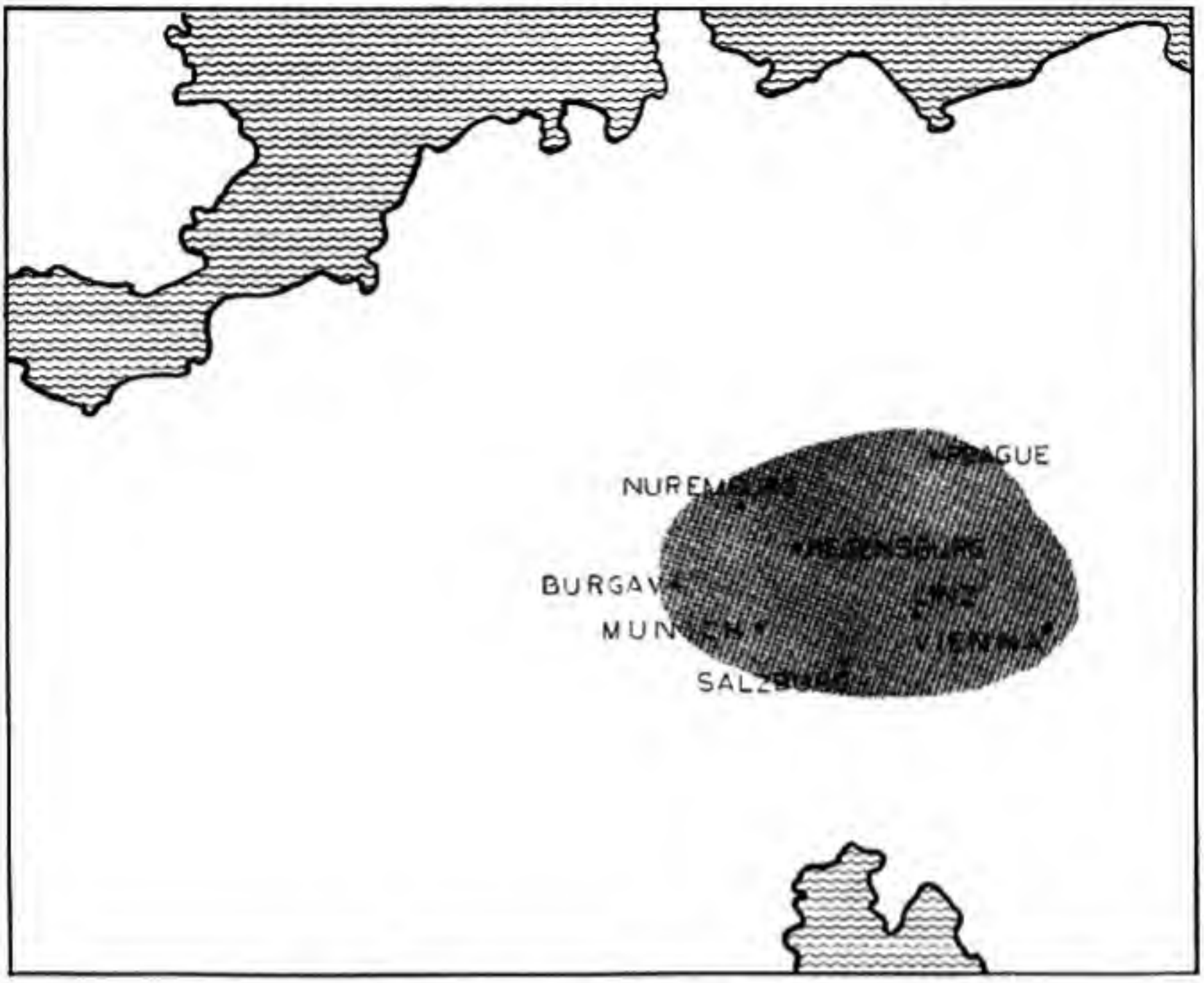

Fig. 18. Distribution of Bellows Guns.

set trigger that taps a release bar. The air, compressed by the sudden closing of the bellows, with much the same effect as a popped bag, forces the projectile out through the barrel.

The resemblance between bellows guns and wheel locks is remarkable. It is characterized by finger-looped trigger guards, heavy and squarish cheek rests, wasp-waisted barrels, ornamental fixed sights, tang peep sights, double set triggers, full forestocks, and heavy butts.

The essentials of the mechanisms are, in principle, also remarkably similar to those of the wheel locks, and embody almost identical features. Similar to the wheel lock, the bellows gun is prepared for discharge by means of a crank. Such a crank is to be seen in the Nunnemacher Collection (174, pl. 10) where it had in the past been wrongly identified. It is not referred to in Metschl's text, but has been cataloged as an accessory to a wheel lock. Experience has proven that a substantial leverage is needed to cock a bellows gun, leverage which is amply furnished by this specimen. In addition to this, the identification is satisfactorily proven on several points. It is different in type and does not agree with any wheel lock spanners known. It is unnecessarily large. Recognized wheel lock keys or spanners are relatively small inasmuch as a lesser strain is present in spanning a wheel lock than in cocking a bellows. The box-end aperture is oversize. Wheel lock axles are rather small, whereas those on bellows guns are recognizably large.

Further, this piece is a comfortable crank to use on a bellows gun, being clumsy on a wheel lock. Judgment may be additionally influenced by the fact that this appendage fits a bellows gun, also an item in the original Nunnemacher bequest, the gun by Jos. Mond (N547). Granting the accuracy of this analysis, the specimen in question is one of two bellows gun cranks of this type known. The U. S. Cartridge Company formerly had the other (231, pl. 29, no. 387).

The box-end crank fits over a square male shaft which connects with the bellows levers. A partial revolution is needed to cock the mechanism, a motion reminiscent of the wheel lock. The internal details vary somewhat, although they are always enclosed within skeleton iron housings, the latter being constructed of iron bands riveted, welded, or brazed into units. The bellows is pulled open, in the single-spring type, this being done by winding a chain partly around the axle shaft which protrudes on the right side near the toe of the butt. This chain is composed of units which are essentially the same as the fusee links associated with early clock mechanisms, and, according to present students (168, p. 56) is an invention of the year 1525. The fusee-type link is also associated with wheel locks. On the double-spring type of bellows gun, in which the axle shaft protrudes midway between the heel and toe of the butt, the halves of the bellows are forced apart, in one case by recognized fusee links, and in the other by a cam arrangement, which, incidentally, is provided with roller bearings. These cams are in reality partial fusee links.

The sear mechanism which holds the axle shaft in open position is structurally the same as that which holds a wheel lock spanned. In the latter the position is maintained by a dog which engages an opening in the side of the wheel. In the bellows gun a similar service is performed by a dog which engages a notch in the side of the shaft. It should be noted in this connection that in the crossbow, and later in the wheel lock, the sear was required to hold a much greater mechanical force in check than the trigger alone could comfortably release, and for this reason a secondary sear was employed. A similar force must be held in check in the bellows gun, and a similar mechanism is necessary. Many of the later spring-and-piston guns have the problem solved by the employment of mechanisms simliar to that used in crossbows, wheel locks, and bellows guns.

Fernand Thevin (227, p. 147) illustrated and described an unusual bellows gun which, aside from the previously noted characteristics, possessed a variant in the cocking mechanism that came even closer to the wheel lock. The cocking stud, instead of being in the butt of the gun, was located at the receiver (as in a wheel lock) and, by means of a longitudinal bar, drew a pivoted lever that forced the bellows open. The lever that was employed for turning the primary stud was located along the right side of the barrel, similar to that on a "Cookson" type of gun, but on the opposite side. This lever, normally held locked by a spring stud, was lifted and pivoted to the rear in an upper arc, thereby causing the longitudinal bar to move forward, drawing with it the lever (at the butt end), causing it to describe a forward and downward arc and, in revolving the axle upon which it rode, expanding the bellows in the usual way.

This piece, in the disposition of its parts, is the nearest approach to the wheel lock yet found. The author, acknowledging as he does that its ornaments are worn, states that the barrel is marked with the name of Wenzel Spatzirer and is dated 1791. With all due respect to Thevin, it is acknowledged that for the purposes of the present study it would have been preferable to personally examine the specimen in order to verify the date, inasmuch as Spatzirer has been identified under other dates. Gardner (87, p. 203) lists him as an arquesbusier of Vienna, 1660; while Stockel (224, p. 289) calls him a Viennese but does not date him, indicating thereby that he may be included in the reasonably antiquated series of makers regarding whom information is rare.

The set trigger, another feature universally found on bellows guns, is, according to Hoopes (125, p. 38), fairly common on heavy, fine crossbows of late manufacture, and on wheel locks. These triggers consist of a great many individual members and exist in highly developed forms, their antiquity being suggested by their complexity. There was a gradual increase in intricacy up to the end of the 17th century, after which time simpler designs were perfected. The set triggers found in the bellows guns are of the complex type suggestive of the wheel lock.

The connection between the set trigger and the sear in the butt is made either by means of a driving rod or by a pivoted link. These mechanisms are also associated with crossbows where a similar distance exists between trigger and sear.

Bellows guns are universally breech loaders, which suggests the use of a dart that cannot be satisfactorily loaded from the muzzle. Ball projectiles seem unlikely, inasmuch as much barrel resistance would be required to hold them in place, and the force generated by the bellows does not appear to be sufficient to overcome any material resistance of such a nature. Also, based upon experience, it is felt as a personal opinion that a lighter projectile would serve better than a relatively heavy ball. This is quite reminiscent of the blow gun.

The breech mechanism is unique, invariably found on the bellows gun as well as occasionally on other air guns, and encountered nowhere else. The makers of air guns do not have to control heavy chamber pressures as do gunmakers who produce firearms, a frequently forgotten fact which permits considerable latitude of design. Illustrative of this is the bellows gun that has the breech opened for loading by tilting upward. The front end of the barrel is pinned to the muzzle end of the full-length forestock, and the hinge upon which the barrel tilts is, surprisingly enough, nothing more than the flexing of the wooden forestock. This is a practical and useful purpose for a full stock. The barrel is normally held in closed, locked position by a lug, there being a variety of designs for this mechanism. The breech closure consists of the juxtaposition of the rear or breech end of the barrel and the front end of a tube attached to the bellows. This breech, a known variant of which is found in the Hall rifle (115) is peculiar to the air gun. Presumably it is first found on the bellows gun, and specimens exist using this system in connection with the piston-spring gun, the air gun with the pump in the butt, and the pneumatic gun with the reservoir in the butt.

The barrel is one of the most interesting components of the bellows gun. It is invariably wasp-waisted (smaller externally at the middle than at the ends) and octagonal in form, being very similar to that used on the wheel lock. Many of the barrels have dove-tailed slugs present which fill corresponding slots for original pin fasteners. While unlined barrels are found, the rule appears to be in favor of brass liners, which in instances reduce the caliber considerably. In the case of the gun by Joseph Mond (174, p. 79), the barrel is plugged at each end by an iron washer retaining a wooden liner. While wood is an unheard-of material in a normal gun barrel, it is perfectly practical in this case as neither fire nor high pressure are involved. In cases where the barrel is original, and not a re-used piece, the external form conforms to the bellows type and a brass liner is also found, as in the instances of altered or re-used barrels. As regards the dating of any of the bellows guns which have been examined, the barrels have been of little value inasmuch as too high a percentage of the specimens encountered have re-used barrels.

The apparent cost of a bellows gun is not consistent with its performance as we have experienced it. One of these was repaired and returned in what appeared to be very close to its original condition (252). The efficiency of the piece after reconditioning did not equal that of the later Quackenbush spring-piston dart guns, of which latter little can be said in favor of either power or accuracy. As a result of the experiments we can see no reason for the very fine sighting equipment present on bellows guns, nor for their obviously expensive construction and ornamentation. Very fine knife sights are usually provided, mounted on dove-tail bases. Rear sights are of the open variety with highly ornamental finials, and are similarly mounted. A very fine V-notch was provided, and some of the pieces have elevation adjustments.

With one exception, all the bellows guns examined are provided with adjustable peep sights fitted to the wrists directly behind the tangs. It is interesting in this connection to note that a wheel lock of German origin, now in the Nunnemacher collection (174, p. 96), is provided with a peep sight mounting base of identical type at the wrist. While we feel persuaded, as was previously mentioned, that darts are the correct projectiles, in our experience the dart, no matter with how much force driven, is not a missile that justifies this fine sighting.

There is no indication that these guns were ever used for anything more than indoor target practice and social shooting by people of means who had the wherewithal necessary to pay for an elaborate arm. This is borne out by the fact that bellows guns are found in highly decorated form, in one case with a hundred or more inlays, again reminiscent of elaborately ornamented wheel locks.

Specimens of bellows guns are found with names on the barrels, presumably the makers'. In view of the previous comments regarding the unoriginality of barrels, it is curious to note that these names, with the exception of Wenzel Spatzirer, are not associated with gunmaking. It appears that the production of these pieces was a craft by itself.

The marked specimens of bellows guns indicate a definitely limited area of

production, which is included within and immediately west of the triangle formed by Munich, Prague, and Vienna. Where the name of the maker only is found, it cannot be located in any source presently available to us. Among the marked specimens two dated pieces occur. One is the Wenzel Spatzirer of Vienna gun previously mentioned, dated 1791. The other is one found listed and illustrated in the Scott & O'Shaughnessy catalog (211, No. 57, item 19) where the following data are given: "Wheelock Rifle Converted to Air Gun. Length 44 inches. Fine specimen, but as there are no working parts, it has no value except for ornamentation. Marked *'Joha Schaz in Burghav, 1807.'* Evidently the time when it was converted into an air gun." This is the usual suggestion given by compilers in the past.

The "Schaz" gun has recently come to light and is at present in the Frank Horner Collection (Madison, Wis.). An examination reveals that the previously noted inscription is present on a side plate on the cheek rest. The barrel marking had apparently been overlooked entirely by the compiler who prepared the catalog in which the original reference is encountered. This mark, which should be accepted as the maker's, rather than that of Schaz, is: "Fran Zelner in Salzb." There is also an armorer's mark with a tent and FZ—not quite like that shown in Stockel, but similar. It is possible that the maker was Franz Xavier Zellner. The barrel is lined with a brass tube with a bit of the old, original rifling showing at the edges of the tube. The mechanism is missing, but it was the single-spring type.

The following names have been found on bellows guns.

HINTZ, CHRISTIAN — PRAGUE, BOHEMIA

The specimen examined is a double-spring gun. In its external appearance, except for the placement of the cocking stud, it resembles the piece by Wistaller.

KUCHENREITER, IOH. ANDRE — REGENSBURG, GERMANY

Laking (148) describes a gun by this maker, although incompletely. It is questionable whether the gun has one or two springs.

LACHERMEIR — MUNICH, GERMANY

A single-spring gun by this maker has been examined. It is rather plain.

MARINGER (M. or W.) — VIENNA, AUSTRIA

A piece by this maker has been described sufficiently (243) to indicate that it is a bellows gun of some variety. Details are vague.

MOND, JOS. — ? ? ?

The example at hand is a single-spring gun (Fig. 19). It is accompanied by one of the very rare cranks.

Fig. 19. Single-spring Bellows Gun. By Jos. Mond. Insert: crank. (Negs. 204549, 204550; Nunn. No. N547)

MULACZ

The example at hand is a double-spring gun (Fig. 20). The barrel is inlaid with silver and bears the name "Anton Mulacz." Also, on the left, the barrel is stamped "MULACZ." The receiver is engraved "Heinrich Mulacz." A Mulacz has been listed as working with Pirko, making breech loaders (224).

PELL, ANTON LINZ, AUSTRIA

A unique example by this maker was described by Fritz Rodke (205). While the stud protrudes near the toe of the butt, it actuates two springs. This is the only example of this mechanism thus far found. Externally the arm is quite plain and resembles the piece by Wistaller (p. 53). Pell is dated c. 1735, rather early for surviving specimens.

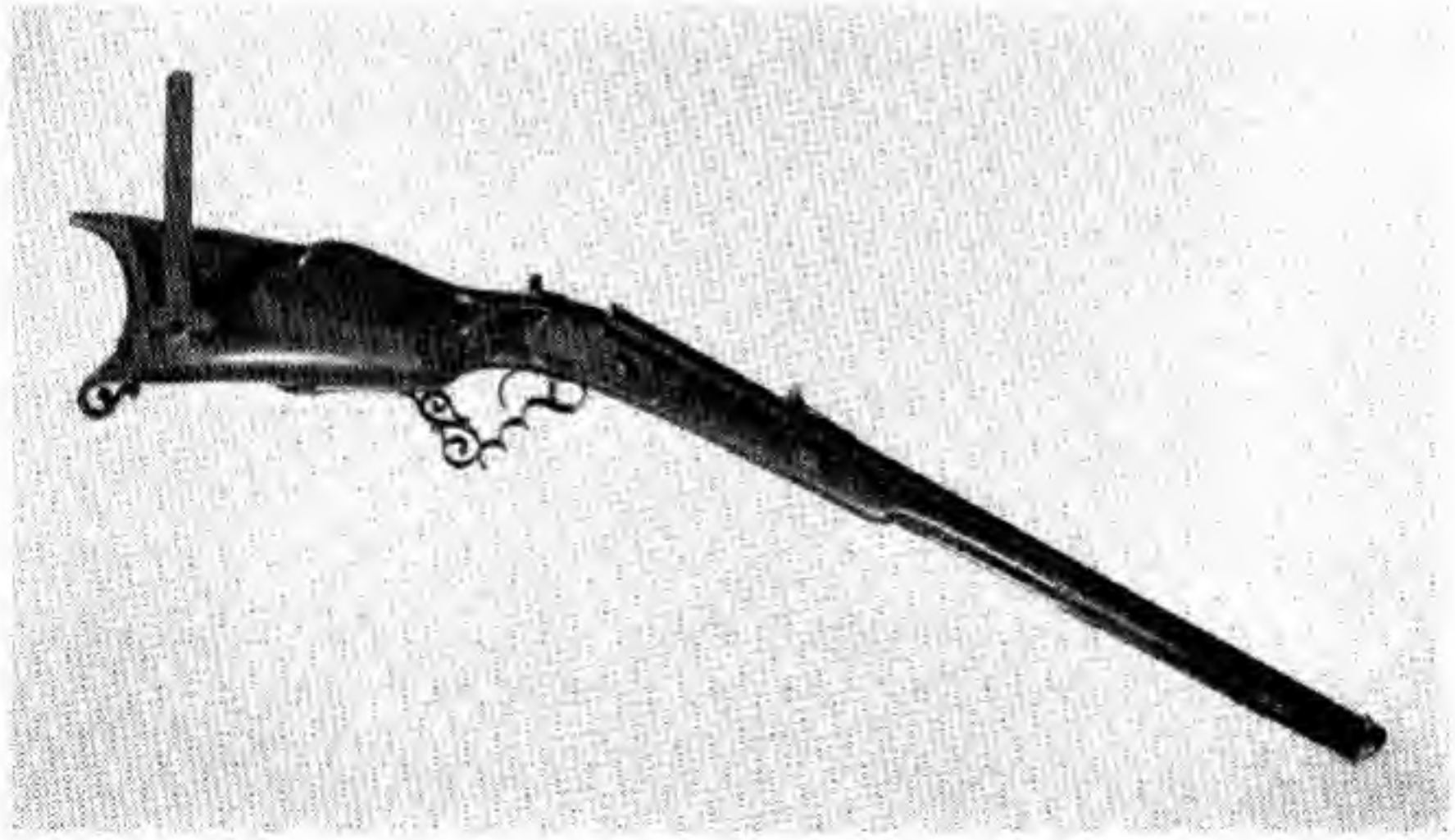

Fig. 20. Double-spring Bellows Gun. By Anton Mulacz. (Negs. 204551; Nunn. No. N10618)

SCHAZ, JOHA BURGHAU ?

This name appears on a side plate on the cheek rest of the "Zelner" gun, which see.

SPATZIRER, WENZEL VIENNA, AUSTRIA

This maker is quoted by Thevin (227). The specimen that is illustrated has the "Cookson" form of outside cocking lever.

VOLKMANN, PET. VIENNA, AUSTRIA

The specimen examined is of the double-spring variety. It is the most elaborately ornamented example so far located.

WISTALLER, F. X. MUNICH, GERMANY

A single-spring bellows gun by this maker has been made available to us by Mr. M. Reichenberger (199). A folding crank is present, one member of which is marked "109;" the other, "110." The discharge trigger consists of a small button only.

ZELNER, FRAN. SALZBURG, AUSTRIA

The barrel of this piece, otherwise known as the "Schaz" gun, bears the name of Zelner. The mark that is present indicates that the maker is Franz Xavier Zellner. The arm is presently in the Horner Collection.

The fact that no appreciable data have been available regarding the makers whose names appear on these guns has been a matter of some wonderment, because the fine craftsmanship exhibited shows the work of masters who must have developed a skill in the production of numerous specimens. These men apparently formed another craft and did not go in for the making of firearms. We note that one air gun maker, Johann Oberlander of Nuremberg, is listed as having been a crossbow maker and an an air gun maker, born 1640, died 1714 (224, p. 230). Stephan of London, an armorer of the end of the 18th century, whose name occurs on a wheel lock as well as on an air gun, the latter preserved in the Musee d' Artillerie of Paris, is also listed (58, p. 598). In another reference he is listed as Stephean (224, p. 293) and is there dated c. 1800, with one specimen examined.

The problem of dating the bellows gun as a mechanism is a peculiar one. Extant pieces are, without much question, quite accurately placed somewhere around the end of the eighteenth and the beginning of the nineteenth centuries. The revival of the romantic movement of the period caused the reproduction of many older objects of art, and appears to have included the bellows gun, even though in a restricted area. This could mean a limit of production knowledge but not necessarily a limit in ultimate use. There is no argument in general with the dating of the specimens that have been examined, but it is felt that, with the peculiar wheel lock characteristics exhibited and the complexity of the mechanism, which, while it varies in the several pieces examined, still follows a definite

pattern, the bellows gun is in reality an older device than remaining examples indicate. To have so complex a mechanism develop within the short space of time in which the specimens have been located, and to find included so many antique features and such a highly perfected expression of art, seems unreasonable. This is particularly true when one bears in mind the fact that highly efficient air guns were known at that time. Why the development of such an inefficient device when better mechanisms were known, unless the bellows gun represents a local example of an attempt to go back to a romantic or golden age?

The seeming contradiction between the late date found on bellows guns and the apparently early nature of the mechanism is one of the most disturbing of of the air gun problems. As has been previously noted, knowledge exists of the invention of air guns at an early date, but this information says nothing as to type—whether they be pneumatic, spring-piston, or bellows guns. Strangely enough, the evidence that most supports the belief that the latter is an early mechanism is negative in character. It is acknowledged that many of the air gun types that were produced in England originated on the Continent. Illustrative are the products of Staudenmayer and Kolbe, two Continental makers who emigrated to England and there produced Continental-type air guns and marked them *London*. Staudenmayer was apparently, as indicated by his products, of Austrian origin. Kolbe, on the other hand, appears to have come from Suhl, Germany (87).

It is thus significant that, while two of the major European types have thus migrated from the Continent, there is no record of a bellows gun being produced in England. It is likewise significant that the French and English encyclopedias of the early nineteenth century make no reference to this mechanism although other types commonly available are illustrated.

Transitional Spring Guns

An unidentified form of spring gun appears to bridge the gap between bellows guns and the type to follow later. Construction, along with lack of data, has led to its arbitrary placement in this portion of the developmental series. Later investigation may well indicate an alteration in position.

One example, unmarked (Fig. 21, upper), is incomplete, but has certain outstanding characteristics. The barrel is of the twist-around form, akin to the Primary New York City gallery gun. A brass cylinder, presumably the housing for a spring and plunger unit, serves as wrist, a possible anticipation of the form encountered in the Quackenbush series.

The butt is of wood, hollowed out for the housing of some mechanism. Careful examination indicates that considerable alteration from the original condition

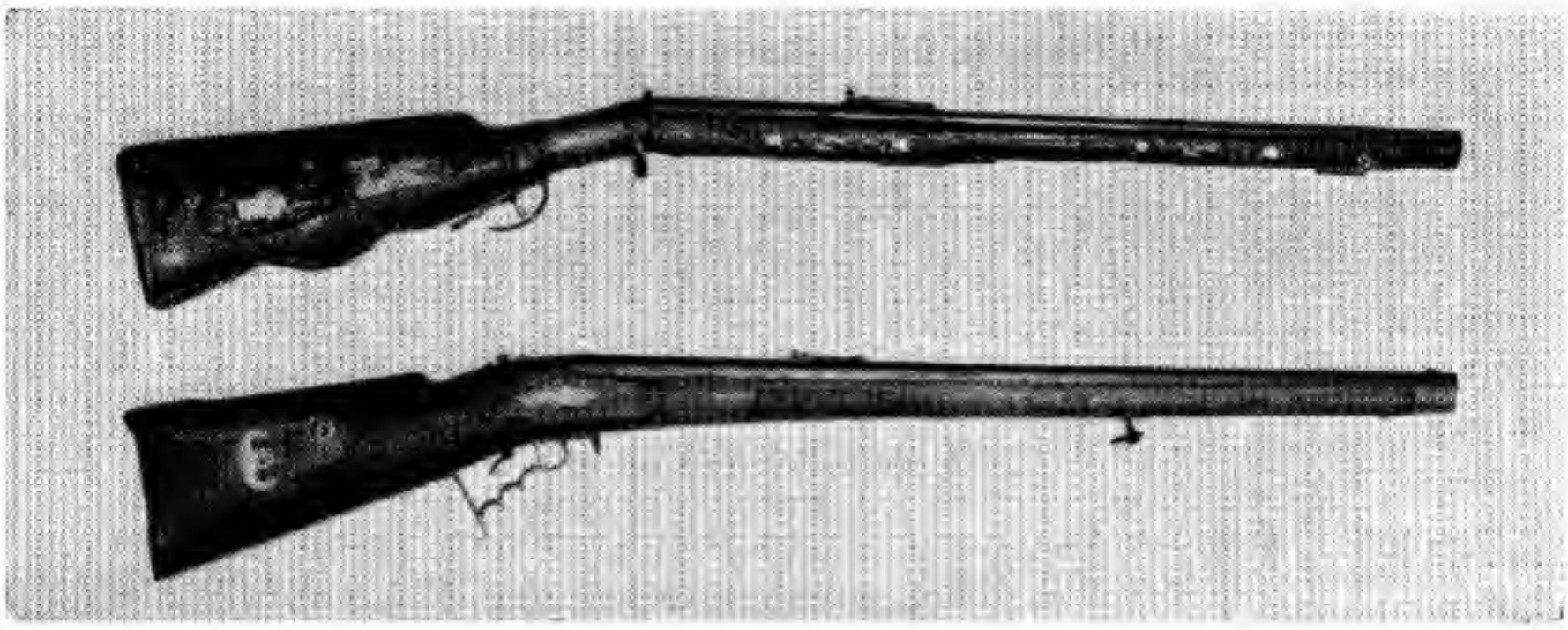

Fig. 21. Transitional Spring Guns.
Upper: Unmarked. The specimen has been rebuilt at least once with evidences of original bellows-type mechanism.
Lower: Weisbrod. This is a transitional example bridging the gap between bellows guns and gallery types.
(Negs. 203267; Nunn. Nos. N2616, N546)

has been made. A cocking stud of the bellows type is present near the butt plate. There are, however, indications of the one-time placement of a cocking lever within the under surface, behind the trigger.

Both bellows-type and gallery-type elements are here suggested. Who produced this hybrid is unknown but, based upon surviving evidence, the specimen is tentatively indentified as a transitional example.

The piece by Weisbrod (Fig. 21, lower), an unlisted maker, has several features quite suggestive of the bellows gun, but has the appearance of the same age as surviving bellows examples, somewhere around the beginning of the 19th century. The expected flip-up barrel is present, as is a cocking stud, recessed, but midway along the right side of the butt stock. The piston cylinder is within the wrist, as in the previous unnamed example, but is concealed within the wood. It may be exposed upon the removal of an inset wooden plate which blends so well with the surface as to be almost invisible.

Both examples were in all probability employed with darts, and very likely had limited capabilities. Fine sights are present as well as peep sight bases. The unmarked specimen has a heavy, wasp-waisted, octagonal barrel; that by Weisbrod has a heavy, straight-sided octagonal barrel with a brass liner. Both have cheek rests. The Weisbrod piece has basket checkering; the unnamed one has inlays of bone, along with a ramrod channel and brass thimbles. They are apparently of German origin.

It is hoped that additional specimens or data will some day become available to bring more light upon this phase of the air gun story.

American Gallery Guns

The period represented by the American gallery guns is a curious interlude which appears to have begun shortly before the Civil War and thereafter survived actively for about one post-war decade. While the picture appears to be reasonably clear in general, actually it is full of unanswered questions regarding origin, descent, and manufacture of an arms type which is unique in structure and use.

It appears that, in the days of limited transportation, shooting was a sport generally denied the dwellers of large cities. Travel facilities were not such that the city folk had ready access to the country and its accompanying sports. With the interest in rifle shooting coming to the attention of urban residents as a result of the Civil War, there developed a realization of the potentialities of rifles, and also a desire to emulate the heroes of the war. Obviously, the noise, smoke, and incidental dangers of firearms made them unsuited for use in densely populated areas. Further, the ownership of a gun other than a pistol was not a part of everyday life there. A means of satisfying this desire and these conditions was found in the American gallery guns, which, as the name indicates, were apparently owned by concessionaires and generally used in indoor ranges.

These curious and generally unappreciated arms, while occurring in a definite variety of designs, have certain characteristics in common. Makers, judging by names, were of Germanic extraction. The guns are highly stylized, using continental European essentials. All are double-volute-spring piston guns using leather bushings. All are breechloaders and, with one exception, were designed to use darts. All have smooth bores. Specific types are identified with specific localities.

Five clearly delineated types of American gallery guns have been identified. They have been unclassified in the past, but because of their apparent origins are here called the Primary New York City, Secondary New York City, Upstate New York, St. Louis, and New England types. The first two are, as the names indicate, essentially products of New York City. The Upstate New York type was produced, judging by available specimens, in Geneva and Rochester, N. Y. The St. Louis type was made in a variety of places, mostly within the Ohio River Basin, westward to St. Louis, where production appears to have been quite concentrated. The New England type, of which two varieties are known to date, was produced in Boston and New Bedford, Mass. A series of questionable types and makers is also at hand. That makers will be identified in other locations at a future date is expected. The present listing is the result of the investigations of over a decade, but obviously no claim is made that it is complete.

Prototypes of the New England and Primary New York varieties are found in Europe. The balance appear to be American designs using European principles, and later examples of such mechanism as, for example, the trigger guard lever and the crank, of European manufacture, are found.

PRIMARY NEW YORK CITY TYPE

This type is known on both sides of the Atlantic Ocean. It is characterized by a detachable crank which is inserted into an aperture in the right side of the receiver, operating a rack within. Specimens of European origin have a pivoted cover over the opening; American examples invariably have the opening exposed. European pieces examined have the breeches tip up for loading. In the domestic variety the barrels twist aside.

Additional characteristics of the Primary New York City type which have been examined are as follows. Octagon barrel with square muzzle. Sights: usually screw adjustable elevating rear sight; otherwise dovetail-based fixed sight. (The latter is on a pistol.) All have fine fixed front sights. The barrel twists one-quarter turn to the right for loading. Because of the strong bolt upon which

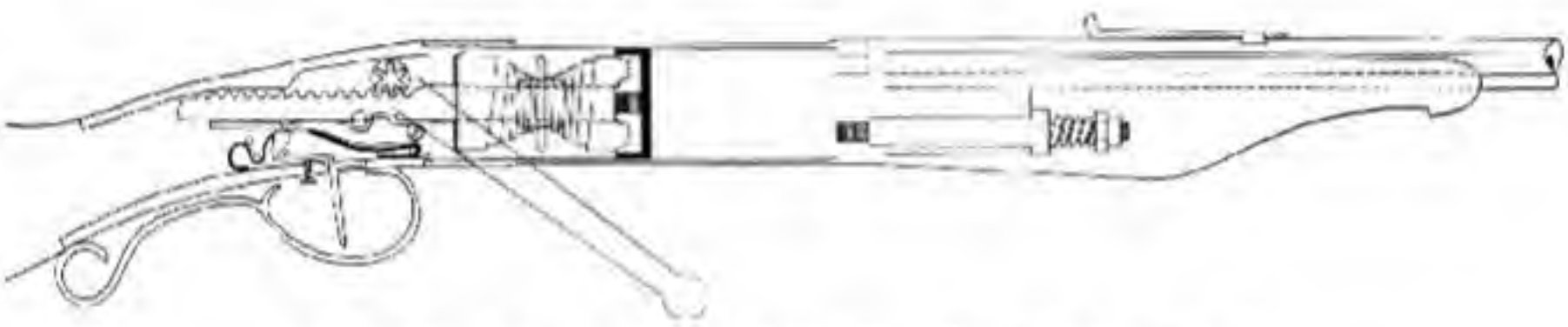

Fig. 22. Primary New York City Type Gallery Gun.

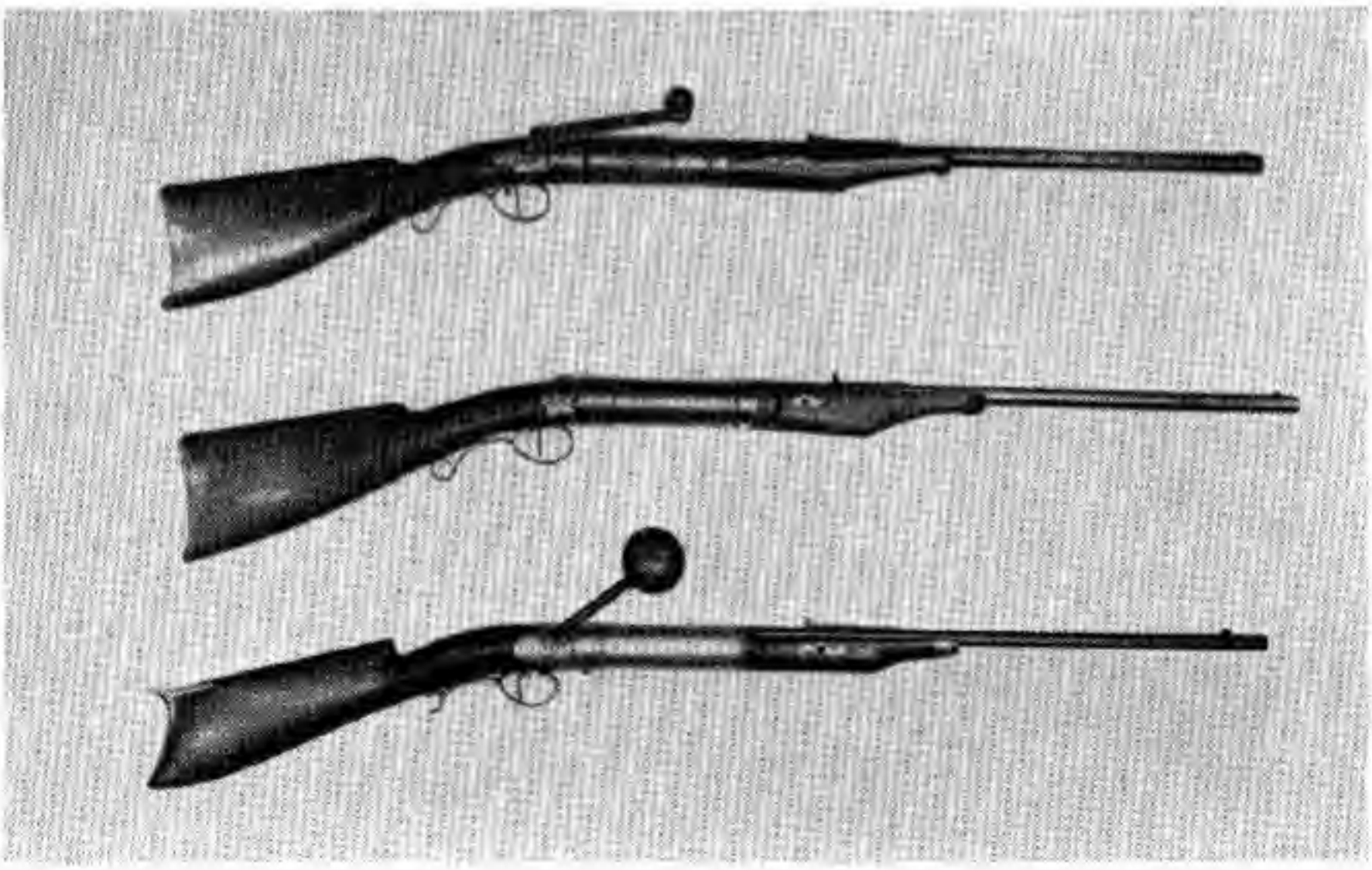

Fig. 23. Primary New York City Type Gallery Guns.
Upper: David Lurch.
Middle: Joseph Lurch.
Lower: Unmarked.
(Neg. 203268)

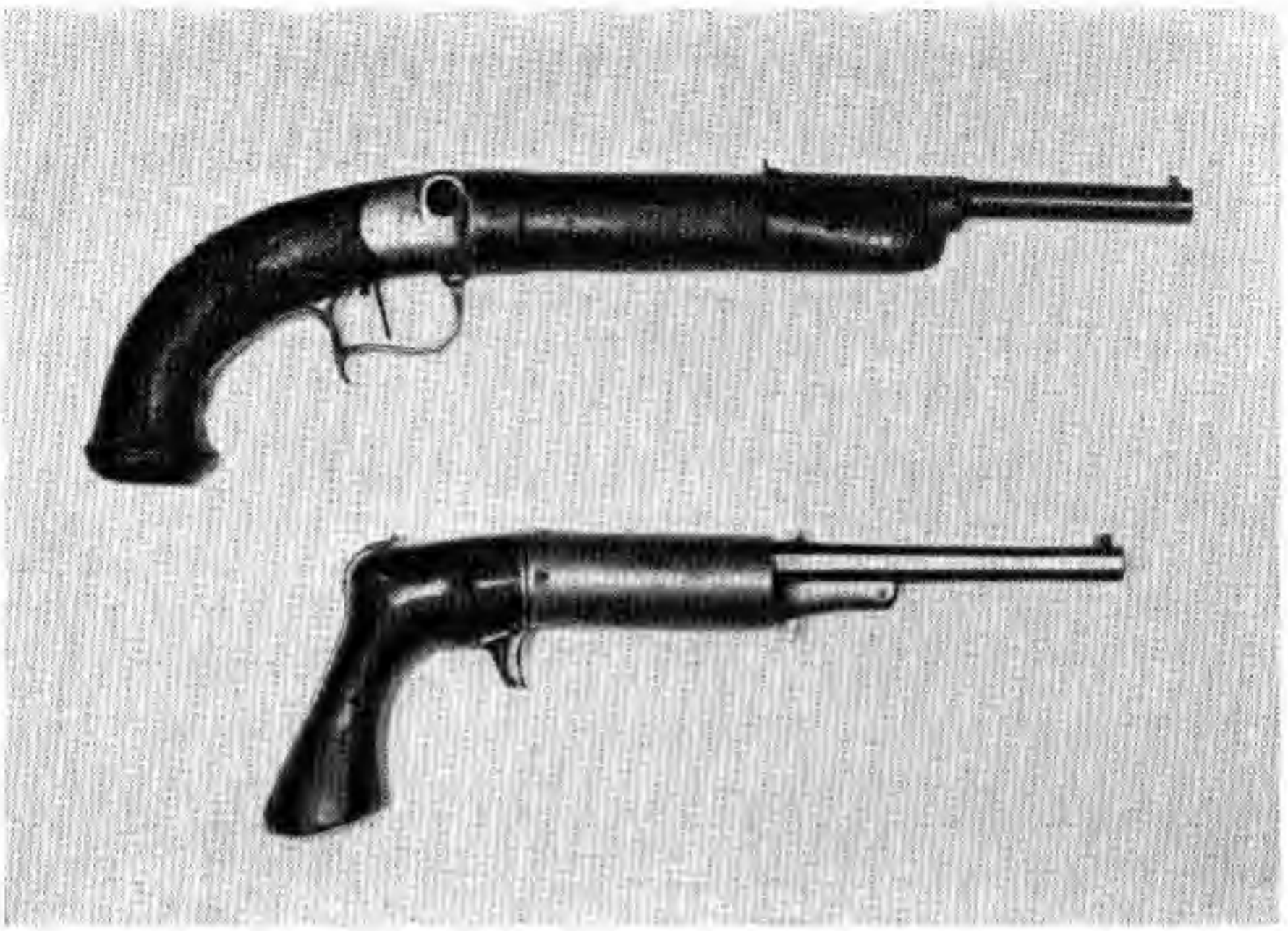

Fig. 24. Gallery Pistols.
Upper: Lurch. Crank type.
Lower: Lindner patent type with butt lever.
(Neg. 203269)

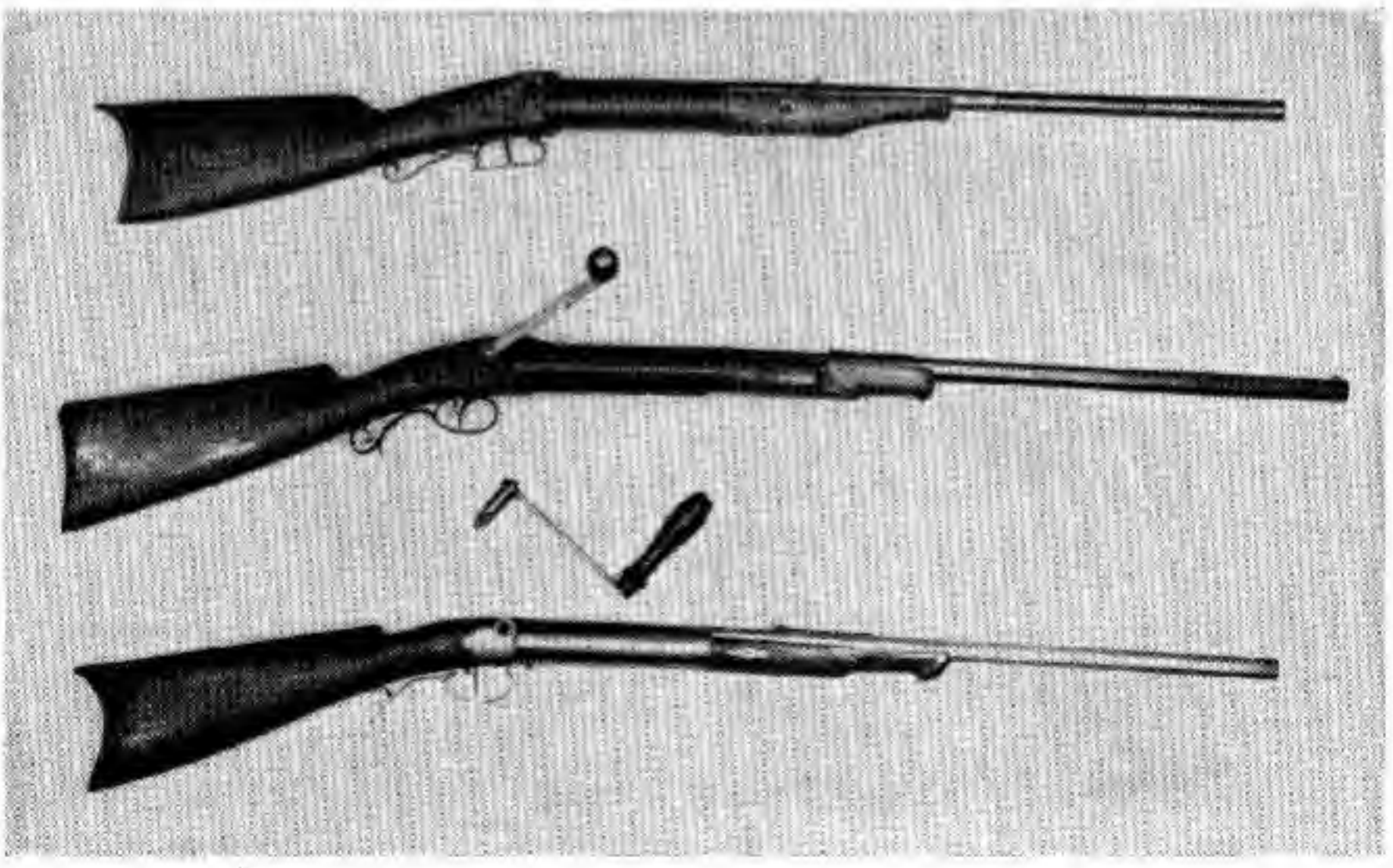

Fig. 25. Primary New York City Type Gallery Guns.
Upper: Unmarked.
Middle: Fisher.
Lower: Mock.
(Neg. 203270; upper, Nunn. No. N3721)

the barrel rides, the forestock is unusually full. It is screwed to the barrel and has screw plates on both sides. (The pistol is pinned.) Perch-belly stocks are the rule, with cheek pieces present on most specimens. Butt plates are either modified military or rifle style. Receivers have top and bottom tangs with rear-extending side tongues. A cast receiver with removable left plate is characteristic, as is the looped trigger guard, also cast. (The pistol has a spur guard.) With one exception, straight pin triggers with rear-affixed adjusting screws are found.

The trigger mechanism is very characteristic of this type of gallery gun. The trigger, pivoting to the rear, elevates the front member of an "L" link, tilting the upper member to the rear, thereby freeing the rear extension of a front-pivoted sear block. The block is thereupon forced downward and out of the rack notch, where it had been resting, this being accomplished by the forward thrust of the spring-tensioned rack bar. The identical mechanical principle is illustrated in a crossbow of Germanic origin in the Nunnemacher Collection (N 466).

In spite of the fact that the forms of the power springs vary, the crossbow, the gallery gun, and also the wheel lock have a common problem, that of retaining the propulsive force of a powerful spring in check by a sear mechanism. Inasmuch as a normal gun sear and notch would not hold this force and release it instantaneously upon demand, intermediate blockades must be employed which, once released, tumble promptly and permit the pent-up power to operate. In the case of the wheel lock a dog enters a depression within the side of the wheel itself and, once released, slides out freely. In the case of the crossbows referred to above, and the gallery gun of this type, the elements of the release are not only identical in principle but also in essential design. A set trigger is employed in the crossbow mechanism, the thrust of which tilts an "L" bar. The motion of this link frees a sear bar, centrally pivoted in this case, the front part of which is thereupon forced downward and out of engagement with the tilting nut, that member which holds the string in drawn position, this motion being the result of the forward tilting strain on the nut. While the design of the parts is different, an almost identical mechanical action, rotated 90 degrees, is present in the wheel lock.

The following Primary New York City type names and data have been collected through direct examination, correspondence, or reference.

BAYER, JOHN — NEW YORK, N. Y.

An example by this maker is known (171). First listed in 1869-70 as "Bayer, John, air gun maker; darts and targets; 117 Prince, h. 164 Delancey." Listed as "guns" in 1871–72; "Machinist" in 1872–73. No entry in 1874. (230.)

FISHER, G. — NEW YORK, N. Y.

Serial number "33" reported (204). Said to have a set trigger. An additional piece marked with this maker's name has been examined (161).

GREYER, W. — NEW YORK, N. Y.

A pair numbered "1" and "2" has been reported. (56, 63, 64).

LURCH, DAVID — NEW YORK, N.Y.

1862-63, No entry for David Lurch.
1863-64, "Lurch, David, spring and air guns & pistols, 142 Grand."
1864-65, "Lurch, David, guns, 142 Grand, (h. refused)."
1865-66, "Lurch, David, smith, 142 Grand (h. refused)."
1866-67, "Lurch, David, gunsmith, 157 Grand."
1867-68, "Lurch, David, spring and air guns 157 Grand."
1868-69, "Lurch, David, guns, 157 Grand."
1869-70, "LURCH, DAVID, spring and air guns, pistols &c., 157 Grand."
1870-71, "Lurch, David, Manuf. of spring and air guns, mechanical targets, springs, darts &c., 157 Grand."
1871-72, "Lurch, David, guns, 157 Grand."
1872-79, ditto.
1886-87, "Lurch, David, sporting gds, 157 Grand."
1893-94, No entry for David Lurch.
1899-1900, No entry for David Lurch.
(230).
Both Lurches, David and Joseph (whom see) are variously listed in other publications of arms makers as gunsmiths of New York City, 1869-75. (87, 208).

LURCH, JOSEPH — NEW YORK, N. Y.

See Lurch, David.
The air pistol noted as the exception in the general discussion of the type (p. 59, Fig. 24) is by this maker. Joseph Lurch signed his name with a reversed "S," noted in every case found, and generally abbreviated as "JOS."

MOCK, AUGUST — NEW YORK, N. Y.

1855-56, No entry for Mock.
1860-61, No entry for Mock.
1864-65, No entry for Mock.
1865-66, "Mock, August, surg. insts., h.r. 85 Sullivan."
1866-67, "Mock, August, surgical instr. mkr. h.r. 85 Sullivan."
1867-68, "Mock, August, machinist h.r. 85 Sullivan."
1868-69, No entry for Mock.
1869-70, "Mock, August, toolmkr., h.r. 85 Sullivan."
1870-71, "Mock, Aug's, Machinist, 59 Lewis, h.r. 85 Sullivan."
1871-72, No entry for Mock.
1872-73, No entry for Mock.
1874-75, "Mock, August, guns, 89 Thompson."
1877-78, "Mock, August, gunmkr, 211 Spring."

1879-80, "Mock, August, guns, 211 Spring."
1881-82, No entry for Mock.
1882-83, No entry for Mock. (230.)

SCHMALTZTERN NEW YORK, N. Y.

One specimen by this maker has been reported (217).

SMITH, GEORGE NEW YORK, N. Y.

One specimen with double set triggers has been reported (232). An example of this maker's work was seen in 1947, at the Milwaukee meeting of the Wisconsin Gun Collectors Assn., owner unidentified. Smith is also listed as a producer of the Secondary New York City type.

SECONDARY NEW YORK CITY TYPE

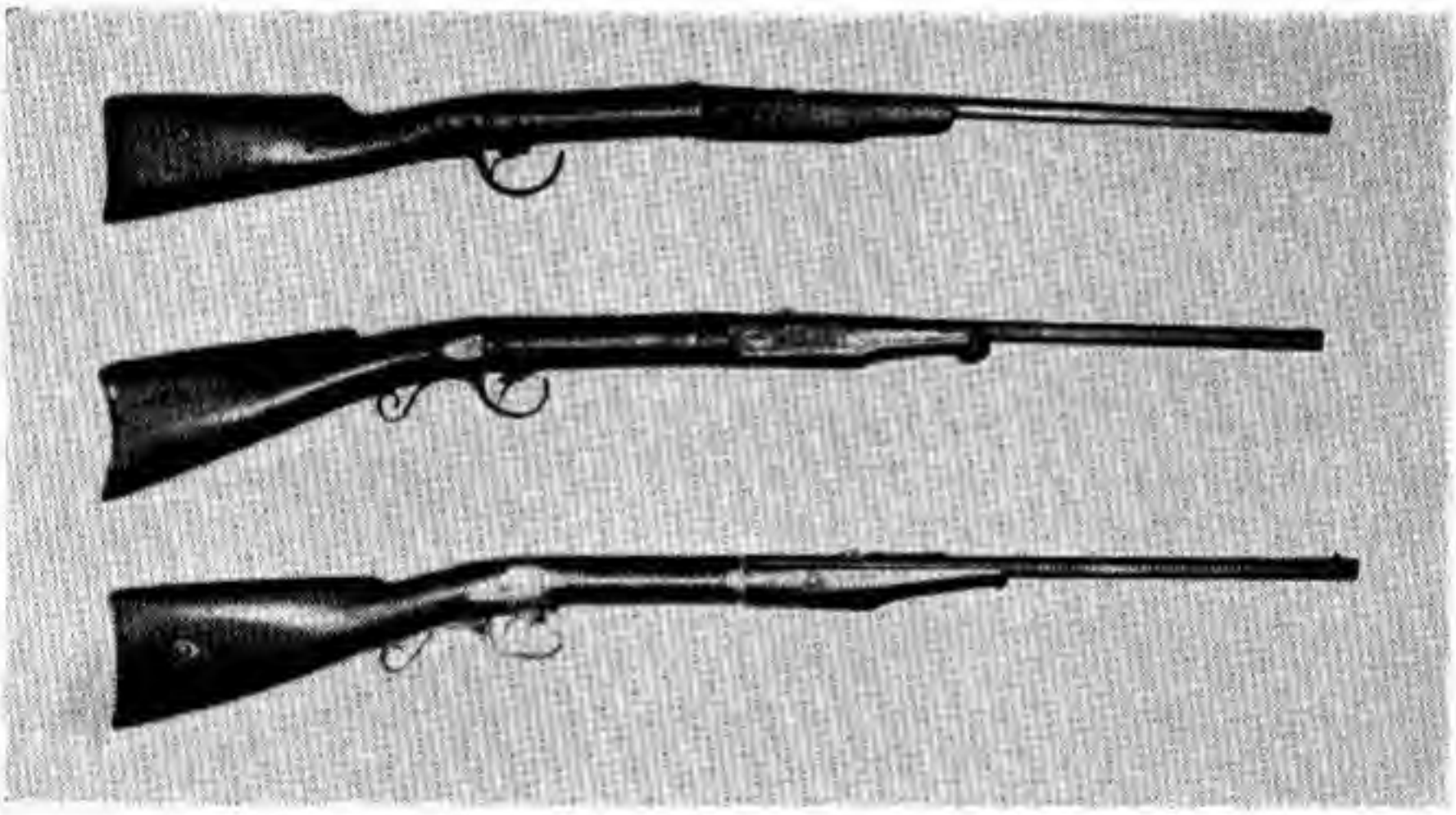

Fig. 26. Secondary New York City Type Gallery Guns.
Upper: Zuendorff.
Middle: Unmarked.
Lower: Liebig.
(Neg. 203271; upper, Nunn. No. N3722)

This appears to be a hybrid form, retaining some characteristics of the preceding type and having added at least one feature of the St. Louis variety. Its place in the progression series is, naturally, still a matter of speculation. Subsequent research may determine a chronological order of the various types; indeed it may show that they are, as is suspected at present, not developments according to time, but truly area forms.

Similar to the St. Louis type, the Secondary New York City variety is equipped with a trigger guard lever for cocking. The barrel, however, in its twist-

around breech, octagonal exterior, and squared muzzle characteristics, is the same as in the Primary form. Side tongues are present on the receiver. A fixed front sight with a dovetail base, and a dovetailed, adjustable rear sight are found. There is a decided drop in the barrel, the bore not being in a continuous, direct line with the exit of the piston and cylinder. The lock agrees with that of the St. Louis type.

In this group the following names are found.

LIEBIG — BALTIMORE, MD.

One example has been made available. Whether the specimen was made in Baltimore by Liebig, or made for him by a New York maker, is not known at present.

RAUB, WILLIAM — NEW YORK, N. Y.

One example by this maker has been reported (235).

SMITH, GEORGE — NEW YORK, N. Y.

This maker has been reported (202). He is listed as also having produced the Primary New York City type.

WIRSING & SCHEMANN — CINCINNATI, OHIO

A pistol is known which is marked "WIRSING & SCHEMANN MAKERS CIN O." It is also marked "G. STEINER," probably the concessionaire or owner. This is an example of a maker producing a type which is rather foreign to the place of manufacture. (43.)

ZUENDORFF, JOHN — NEW YORK, N. Y.

The specimen of this maker in the Nunnemacher Collection (N3722) is generally credited to "106—East Houston St." Reexamination shows that the piece is marked "John Zuendorff New York" not only on the rear of the cylinder but also in almost obliterated letters near the breech of the barrel. The barrel is also marked "5" below, the number normally being covered by the forestock. No Houston nor East Houston Street is to be found in the New York City Directory of the period. No town nor place such as Houston or East Houston is in New York State. The marking is believed to mean number 106 from E. Houston's shooting gallery, or gun number 106 owned by E. Houston. There is no E. Houston listed as an owner of a gallery (230), but one such person is noted as being in the popcorn business. He could have been a concessionaire or a supplier of concession apparatus. This gun is credited as an item used in the draft riots during the Civil War.

UPSTATE NEW YORK TYPE

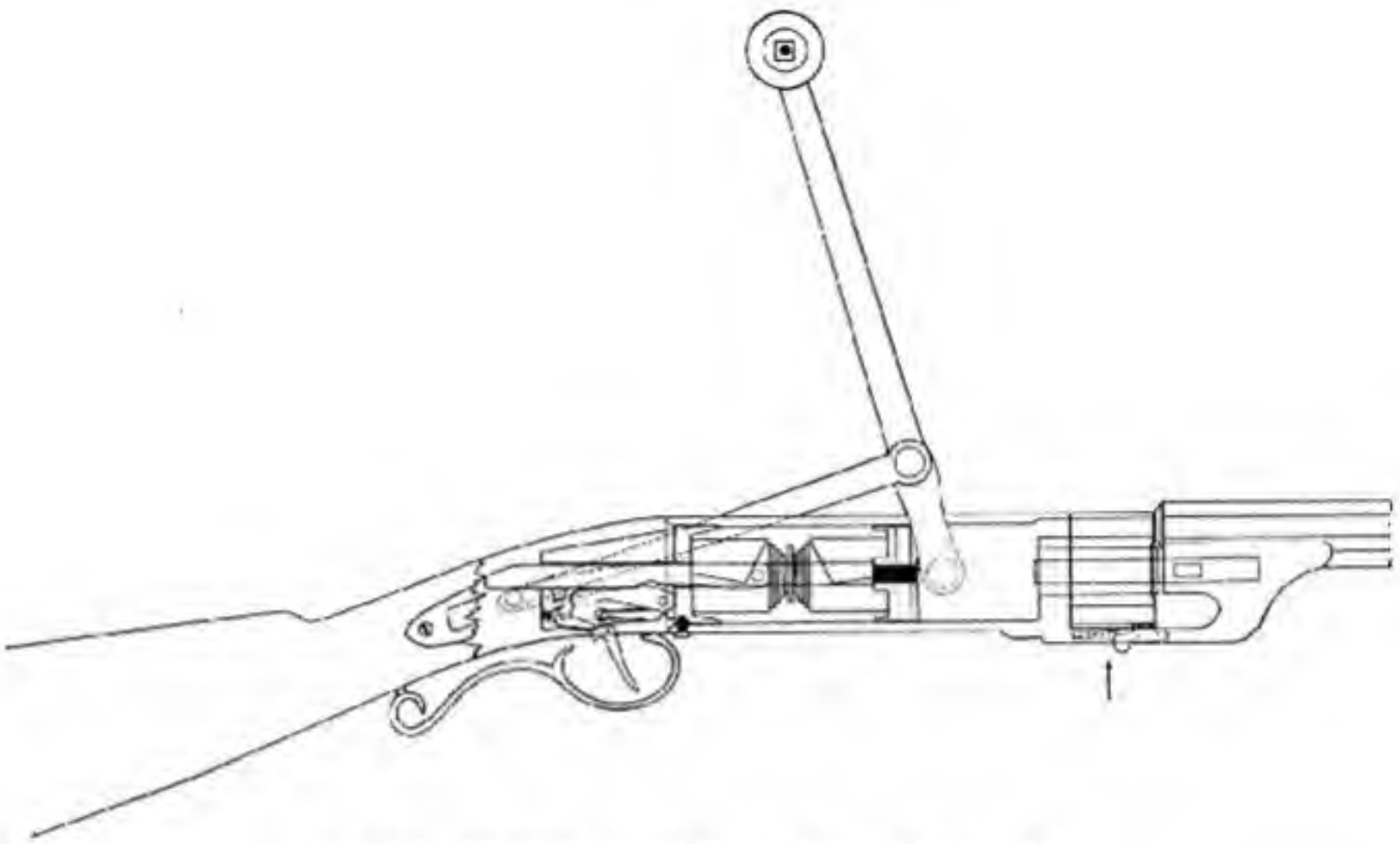

Fig. 27. Upstate New York Type Gallery Gun.

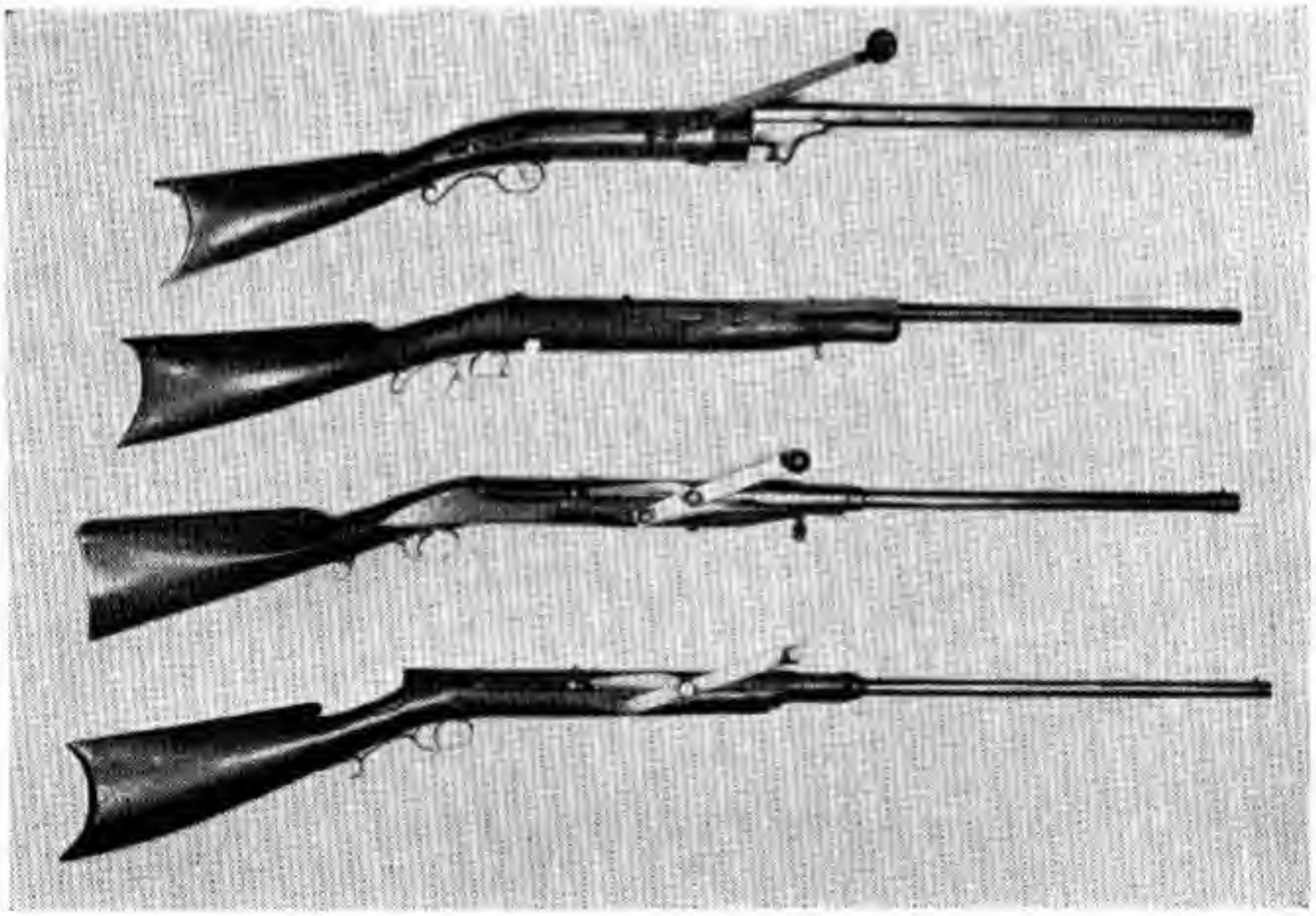

Fig. 28. Gallery Guns.
1st. Upstate New York Type Gallery Gun, Bunge.
2nd. New England Type Gallery Gun, Eggers.
3rd. New England Type Gallery Gun, Tonks.
4th. New England Type Gallery Gun, Tonks.
(Neg. 203272)

Here we have a merging of the New York City and New England types. The principal characteristic is the hand-operated revolving cylinder. A revolving air gun is not surprising in this locality which also saw the first use of the revolving rifle in America. One maker of revolving air-guns, C. Bunge, is also credited with making pill-lock revolving rifles—probably of the Miller type (208). Miller's arm was patented on June 11, 1829, and thereafter enjoyed considerable popularity in the region of its origin, although made by several manufacturers (104, p. 510). The cylinder of the spring gun may be long for darts or short for balls, or it may be a combination of a cylinder that turns and a stationary portion that acts as a magazine to replenish the revolving cylinder (38). In this type the barrel attaches to the receiver with a pin, wedge, and bottom strap combination, a design very similar to that employed on the Colt open-top revolver. The trigger mechanism is identical to the Primary New York City type. The side lever resembles that used on the New England pieces. Two makers have been encountered up to the present, as follows:

BUNGE, CHARLES — GENEVA, N. Y.

This maker was listed (51) in 1862 63 as a model builder, in 1870 as a machinist, in 1879 as a gunsmith, and in 1894 as a machinist and gunsmith. He made side-lever guns with 12- or 13-shot revolving cylinders. On August 31, 1869, he secured a patent for a "Revolving Spring Toy-Gun." The patent shows a 12-shot double cylinder with a stationary cylinder to the rear, which is to feed into the revolving one. The latter is one caliber long. The patent shows a design for a 55-shot gun. Air guns having these features are known. Bunge is also reported as having made pill-lock revolving rifles (208).

WERNER, C. — ROCHESTER, N. Y.

An example of this maker's work is known that has a 12-shot cylinder. The gun is stocked in oak (81).

ST. LOUIS TYPE

Fig. 29. St. Louis Type Gallery Gun.

This variety is cocked by pulling down and back on the trigger guard which forms the end of a lever normally concealed in a groove in the under surface of the butt stock. Barrels with crowned muzzles are octagonal and tip up at the breech for loading. The pivot for this purpose is a few inches ahead of the breech, under the barrel. Release latches occur in a variety of designs. Forestocks are of

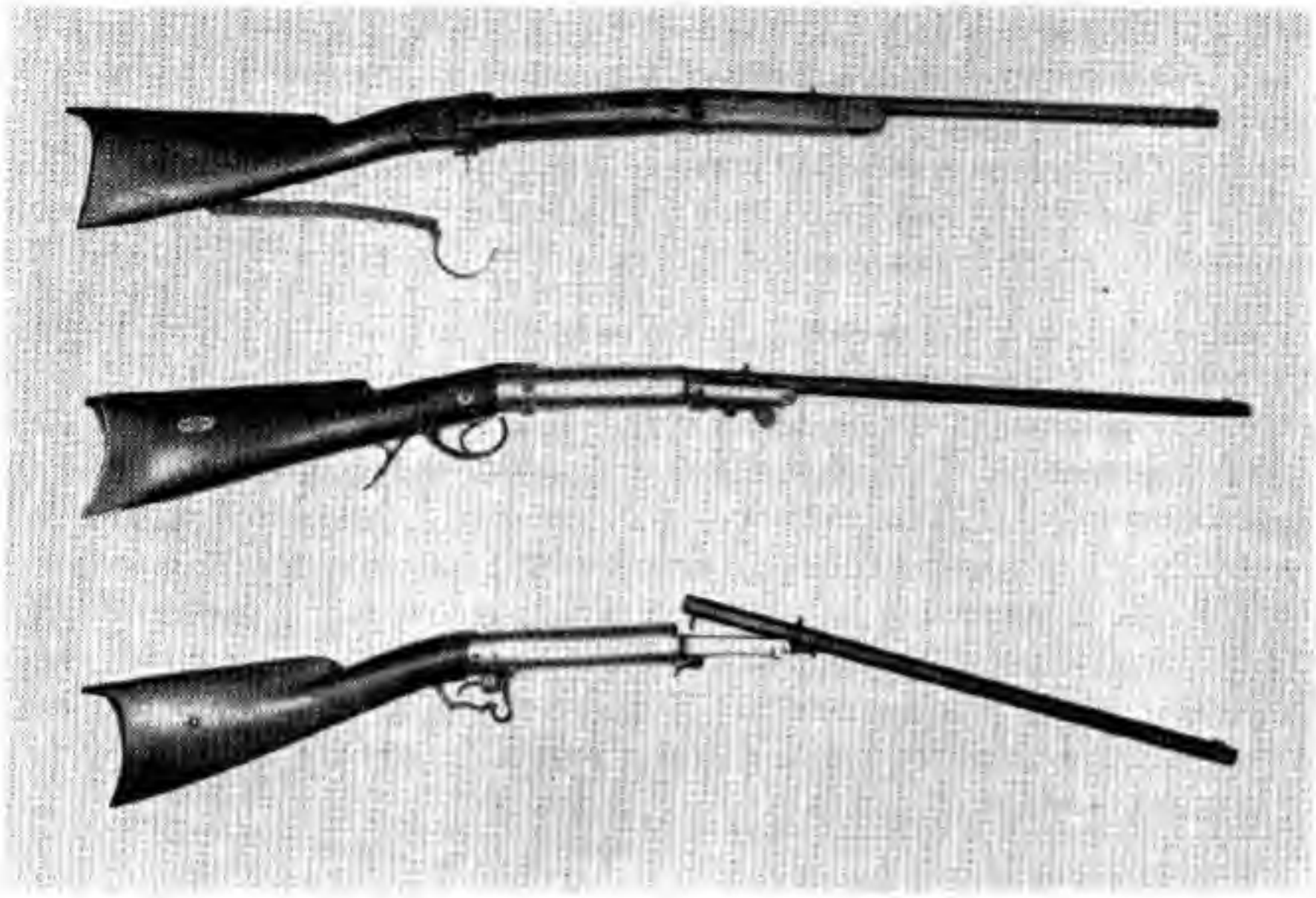

Fig. 30. St. Louis Type Gallery Guns.
Upper: Unmarked.
Middle: Stein.
Lower: Unmarked (Johnston, Great Western Gun Works?).
(Neg. 203273)

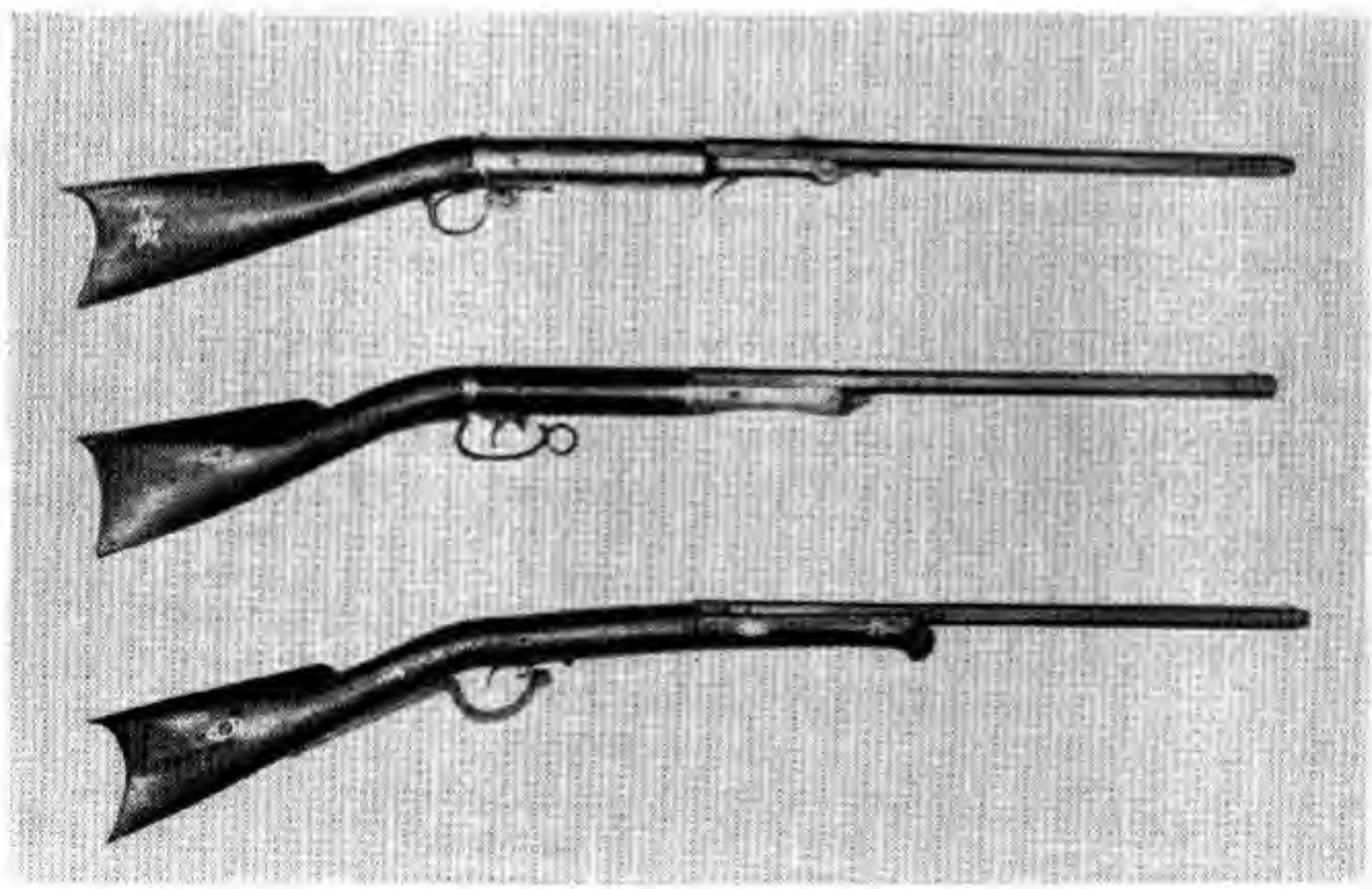

Fig. 31. St. Louis Type Gallery Guns.
Upper: Gartner.
Middle: Blickensdoerfer.
Lower: Linzel.
(Neg. 203274)

brass in most cases. The wooden butt stocks are usually fastened to the ends of the cylinders by wood screws, although they are sometimes reinforced by top or side straps. The trigger and trigger-release mechanism are usually fitted into a slotted lug below the cylinder, at the rear. Certain examples of this type of gallery gun show a decided downward tilt of the barrel below the axial line of the cylinder and the corresponding line at the top.

The cocking lever is mechanically the same as the goat's-foot lever employed in crossbows. It draws back the piston rod against volute springs, the rod meanwhile passing through a vertically placed, perforated sear block. The block is forced downward by a top-placed leaf spring and engages a depression in the upper surface of the piston rod. The sear block is then held in downward position by the trigger, which enters a notch near the bottom of the rear surface of the block. Drawing the trigger to the rear disengages it from its notch with slight effort. The block is then forced upward out of the depression in the piston rod by the forward thrust (spring impelled) of the latter. An adjusting screw is usually present on the trigger and may create the impression that a single set trigger is present. Sights vary.

The list of makers of the St. Louis type gallery guns is very satisfying both from the point of view of numbers and distribution. Presently known makers are the following:

BANDLE, J. CINCINNATI, OHIO

"BR-1. Very odd American air rifle with center air chamber and 23", .25 cal. octagonal barrel, which tips down to load. The handle of the lever is the trigger guard. This is signed by the maker, J. Bandle, 260 Main Street, Cincinnati, Ohio" (139).

BASLER & DENK ST. LOUIS, MO.

A specimen has been reported with a ring on the trigger guard, similar to the Blickensdoerfer. It is engraved "Scharf & Son" (161).

BLICKENSDOERFER, JOHN ST. LOUIS, MO.

A specimen that has been examined has a ring on the front of the trigger guard. Serial numbers 28 and 66 have been examined. This maker is listed in the 1864 directory (68) as JOHANN BLICKENSDOERFER, gunsmith.

In the 1865 City Directory the following advertisement is found:

"JOHN BLICKENSDORFER
Manufacturer of
Guns, Rifles, Pistols & Air Guns
No. 7 South Third Street
Bet. Market & Walnut
ST. LOUIS .....MO.

Repairing done with neatness and dispatch,
and at the shortest notice."

In 1869 the listing appears as Blickensdorfer & Schilling. Blickensdorfer is not listed in 1875. See Schilling.

BLICKENSDORFER & SCHILLING ST. LOUIS, MO.

See Blickensdoerfer and also Schilling.

BRECHT, GUSTAVUS V. ST. LOUIS, MO.

(68: 1864, 71, 73, 75.) One specimen has been reported marked number 3, no details. The name on this piece is "G. C. Breght" (36). Brecht is reported as having operated a machine shop making butcher's machines. Another specimen is reported as marked "G. V. Breght" (161).

BREITENSTEIN, I. ST. LOUIS, MO.

A specimen agreeing with the type is known (161). No listing has been found in directories.

GARTNER, J. COLUMBUS, OHIO

A specimen agreeing with the type has been examined.

GREBLES, A. CHICAGO, ILL.

One specimen with serial number 8 has been reported (114).

HEBERLEIN, A. ST. LOUIS, MO.

A specimen agreeing with the type is known (161).

JOHNSTON, J. H. PITTSBURGH, PA.

This was probably a dealer only. The same gun illustrated in the following catalog is also in a catalog of P. Powell, which see. It may have been a standard cut supplied by the maker. An advertisement (136, front cover) claims: "Guns, Rifles, Revolvers, Ammunition, and Sporting Goods, Manufactured and for Sale Wholesale and Retail by J. H. Johnston, at the Great Western Gun Works, No. 179 Smithfield Street, Pittsburgh, Pa."

The catalog which bears the above includes (136, p. 17) an illustration of a gallery gun of the proper type, with the following notes:

"AIR OR DART GUNS

For Fairs, Pic-Nics, Shooting Galleries, Saloons, &c. Best quality spring air gun with one dozen darts and paper targets $35.00

Extra main springs, per pair 3.00

Extra darts, per dozen ..... 2.00."

The following testimonials are also included.

"Stryker, O., February 3, 1873

Mr. J. H. Johnston—

Sir: The air gun is all O.K. It has half paid for itself, including express and other charges. It did that in ten days. If I had charged as much for shooting as most of them do, it would have done a great deal more. I am giving four shots for five cents, ii that ain't low I miss my guess.

Yours,

J. R. Barnum" (136, back cover).

"Stuyvesant Falls, N. Y., September 13, 1872

J. H. Johnston—

Dear Sir: The guns were received, all in good order. The boys tested them in almost every manner, and they pronounced them first-class shooters. The air gun is far superior to any that has yet been produced in this town. A sample: it was shot at 70 feet, 3 times; once it struck 14, then 15, and the third time it hit the target direct in the eye. This was called very good shooting for 70 feet, and I presume you will call it the same.

Truly yours,

J. A. Dick" (136, p. 62).

LINZEL, A. E. ST. LOUIS, MO.

In the 1864 directory (68) Edward A. Linzel is listed as a gunmaker, 63 Walnut. Also listed under "Guns & Pistols" and "Gunsmith."
1865: Same as above, only "Gunsmith."
1869: Linzel, E. A., guns and pistols, 822 N. 5th.
No listing as gunsmith in 1871, 1873, 1875 directories. Five specimens have been recorded, one having been examined (35; 161).

POWELL, P. & SON CINCINNATI, OHIO

A catalog (189, p. 5) dated 1875 lists a gun of the St. Louis type, but there is no proof that Powell was a maker. Probably he was a dealer only. The illustration is the same as in the catalog of J. H. Johnston, which see.

SCHILLING, FREDERICK ST. LOUIS, MO.

Schilling is listed as working for Blickensdoerfer in 1865 (68). The name is given as Blickensdorfer & Schilling in 1869. One specimen so marked, numbered 124, is known (83). The firm is not listed in 1875, but Frederick Schilling is listed as a gunsmith, r. 2529, Columbus, and Charles F. Schilling at the old address of 12 S. 3rd.

STEIN, W. CAMDEN, N. J.

One specimen has been examined. It has a retaining pin near the breech of the barrel for use in shooting ball. Beginning with the earliest directory (145) that includes the name, this maker is listed as follows:

1860-69. WILLIAM STEIN, 215 Market St., Gunsmith.

1869-73. WILLIAM STEIN, 309 Federal St., Gun and Pistol Manufacturer (The address henceforth remains constant).

1874-92. WILLIAM STEIN & WILLIAM Jr., Gun and Pistol Manufacturers.

1902-06. WILLIAM STEIN, Jr., & Bros. (Wm. Jr. and Louis E.), Gunsmiths.

1906-13. WILLIAM STEIN, Jr., & Bros. (Wm. Jr., Louis E., & Charles H.), Sporting Goods.

1915-17. WILLIAM STEIN CO. (Louis E., Chas. H., & Herman C. Engel), Sporting Goods.

1917-40. WILLIAM STEIN, CO. (Chas. H. & Herman C. Engel), Sporting Goods.

1940-date. WILLIAM STEIN, CO. (Herman C. Engel) Sporting Goods.

NEW ENGLAND TYPE

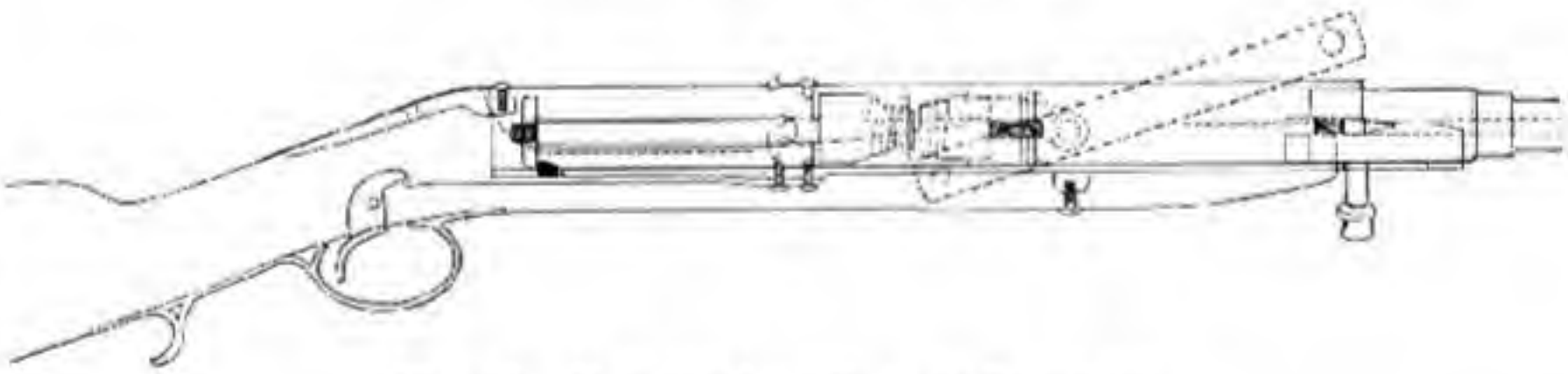

Fig. 32. New England Type Gallery Gun.

The immediately apparent characteristic of this type is the one-piece sporting style stock. A lever on the right side swings in an upper, rearward arc and, by means of a link, draws back the piston rod. A washer at the end of the rod is engaged by a stud, serving as a sear, which is fastened to a long leaf spring. The spring is tensed upward and forces the sear lug in that direction into an opening in the continuation of the piston cylinder. A simple trigger bears downward upon the rear extension of the leaf spring, pulling the sear downward, thereby disengaging it from the washer. The rod and piston may then move forward in the usual manner. This release matches in simplicity the one used later by Quackenbush.

Of the three examples presently known, two are by the same maker. In addition to the above, all are characterized by cylinders of small diameter which

serve as the housing for the entire mechanism except the trigger. The cylinders are bedded in the stocks. Trigger guards are equipped with modified loops.

The two makers who have been identified to date are the following:

EGGERS, S. (Samuel?) NEW BEDFORD, MASS.

One specimen examined has a barrel which tips up at the breech, as in the St. Louis type.

TONKS, J. BOSTON, MASS.

Two examples by this maker have been examined. They have a unique breech. The barrel turns partly in a counter-clockwise direction and is then pulled forward. It tilts in a loose fashion within a ring on the forward end of the cylinder for loading. A similar one is known (161).

UNKNOWN OR QUESTIONABLE MAKERS

BASLER, JOHN NEW YORK, N. Y.

Trigger guard lever, unknown breech (124; 203). See Basler & Denk, St. Louis type.

DICK, F. R. BUFFALO, N. Y.

Crude air gun with detachable goats-foot lever. Probably an inventor's model. Formerly in the Horner Collection.

GEMMER, J. P. ST. LOUIS, MO.

Air guns reported, no details (36).

KUGLER, A. KINGSTON, N. Y.

Air guns reported, no details (208).

LINDNER, E. NEW YORK, N. Y.

The U. S. patent for "AIR-GUN," dated Dec. 16, 1862, (155) illustrates the usual tip-down barrel of the St. Louis type. It has a cocking lever which fits into the front strap section of the grip (Fig. 24, lower).

LINDNER & MOLO NEW YORK, N. Y.

Air pistols reported, no details (232).

LUNSMANN, F. ST. LOUIS, MO.

Air guns reported, no details. One specimen is dated 1865, but no additional data have come to light (138). The St. Louis Directory (68), has the following listed under "GUNSMITHS:"

1864. Lunsmann, Franz, Gunsmith, 153 s. 2nd.
1865. Lunsmann, Francis, Gunsmith, 103 s. 2nd.
1869. Lunsmann, Francis, Gunsmith, 410 s. 2nd.
No listing in 1871, 1873, 1875 directories.

MOON, A. NEW YORK, N. Y.
One catalog reference is known for this maker (234). It is possibly a confusion with A. Mock, Primary New York City type, which see.

MUNCK, C. H. WASHINGTON C. H., OHIO
This maker is mentioned, no details (232). He is ascribed to Washington D. C., but the peculiarity of the listing suggests the Ohio locale.

RAQUET, C. CINCINNATI, OHIO
Maker mentioned, no details (232).

SYMS, J. G. NEW YORK, N. Y.
One specimen reported, no details (134). The address on the specimen: 44 Chatham St., N. Y., indicates beyond doubt that this is the "Syms" of BLUNT & SYMS.

UEBEL, CHRIS. LOCATION UNKNOWN
It is questionable whether this is a maker or an owner. The reported specimen (161) is said to have double barrels. Apparently both were discharged simultaneously. The cylinder is described as being made of wound iron wire.

While we do not know definitely whether the *bügelspanner*-type air gun, as it is known in Germany, developed in America and then went to Europe, or whether it developed in Europe and came to America, the former seems to be the case. The migration appears to have occurred somewhere in the 1870's. Recent cata-

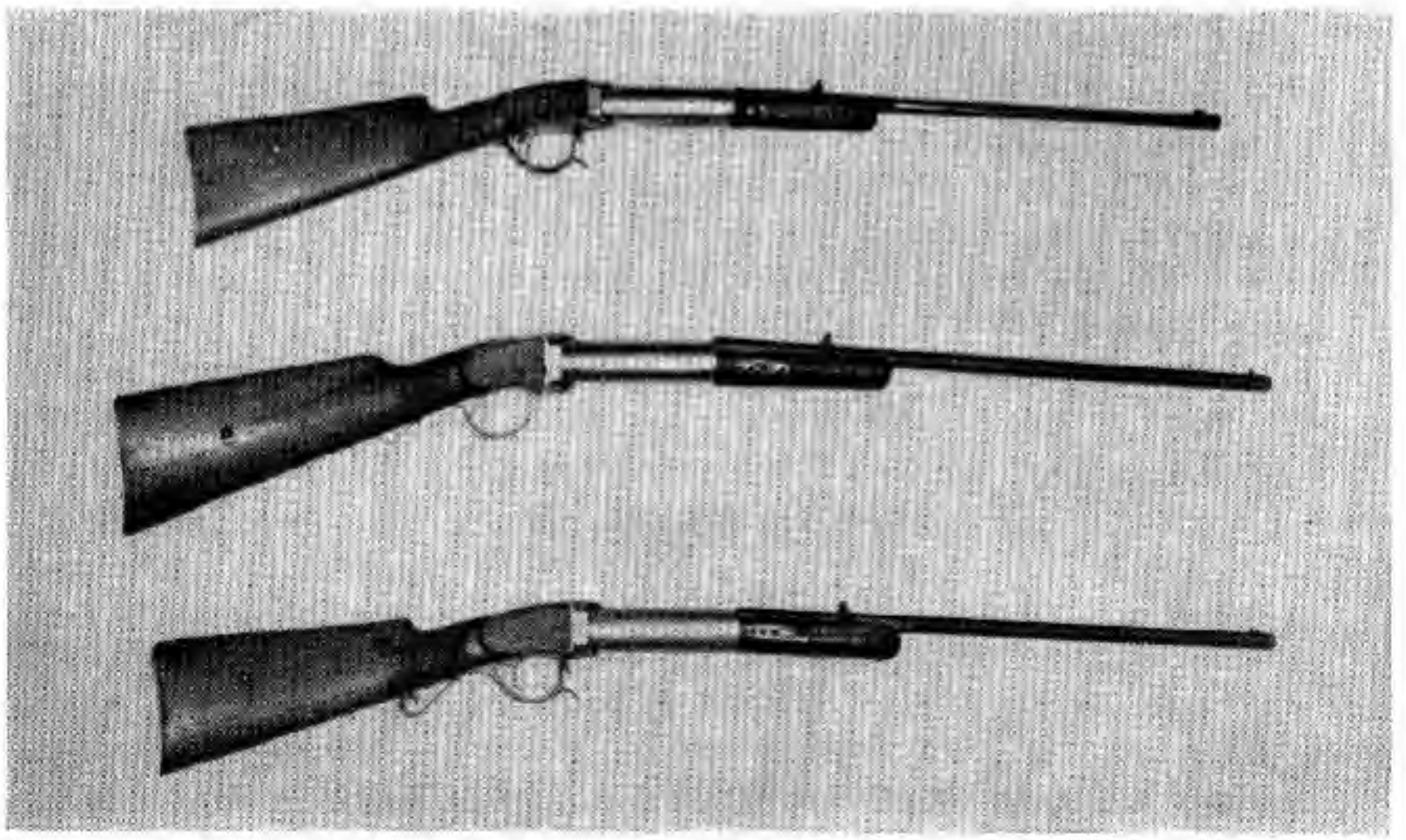

Fig. 33. European Trigger-guard-lever Spring Guns.
Upper: Unmarked.
Middle: Original Will.
Lower: Original.
(Neg. 203275)

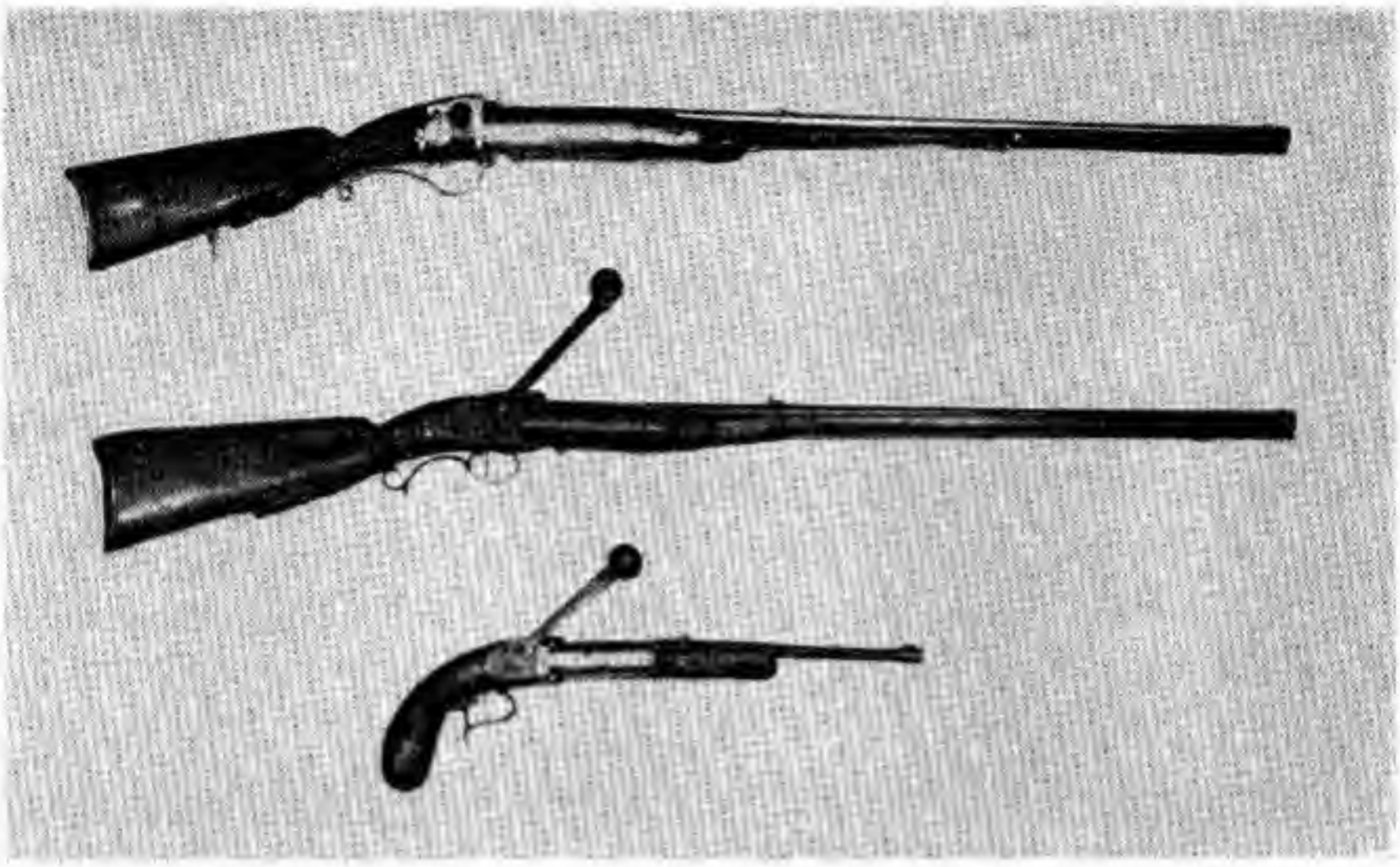

Fig. 34. European Crank Spring Guns.
Upper: Rutte.
Middle: Carl Friedrich.
Lower: Marion & Sanner.
(Neg. 203276)

logs and articles (98) indicate that this type of gun is, or was until very recently, current on the continent, particularly in Germany and Switzerland. Both crank and trigger-guard lever varieties are illustrated (Figs. 33; 34). Barrels appear, in all cases known, to be the tilting kind.

The migration is curious. While spring guns were known in Europe, they appear to have reached a remarkable development here, thereafter going overseas. On the other hand, pneumatic pressure guns were developed to their very highest degree in Europe and then came to this country, where they exist primarily as small-bore weapons. An article by Harrison (107) is suggested as supplementary reading.

Quackenbush

Henry Marcus Quackenbush was born in Herkimer, N. Y., on April 27, 1847 (198). Without pay and in order to learn the trade, he started working for the Remington Arms Co. in Ilion, across the Mohawk River from Herkimer. The story is told that, when one of the Remingtons returned from a trip to Europe, he was surprised to see potted plants in one of the windows of the factory. Going into the building to find out more about this strange matter, the owner discovered young Henry Quackenbush operating a machine, and noted that the machine was turning out about twice as much production as recollection

indicated it had been capable of doing in the past. When asked about the attachments which had speeded up his machine, Henry admitted that he had made them from scrap material on his own time. In the best Horatio Alger tradition, Quackenbush was promoted to the tool room and to the payroll.

He is first officially noticed as a witness to the patents of W. H. Elliott, numbers 47,707 and 50,232, granted on May 16 and October 3, 1865, respectively (69). On October 22, 1867, Quackenbush (190) patented the now familiar extension ladder and with the money secured from its sale bought tools to go into business for himself. This he did in 1872.

In the Scientific American (210) he advertised the sale of an air pistol, patent no. 115,638, June 6, 1871 (191). The design of that pistol, which was cocked by pushing in the barrel, was basically the same as that of the No. 1 Quackenbush air gun, which was to prove the most popular item in the line.

Quackenbush, with his No. 1 air gun (197), had an effective substitute for the expensive hand-made gallery gun which had been produced during the previous decade. Inasmuch as his weapon had only fifteen parts as against the twenty-seven in a typical New York gallery gun, and weighed only three-eighths as much, there was little question about successful competition. In place of the expected rolled and soldered cylinder, measuring approximately 1⅝ to 1¾ inches, there was substituted in the new arm a forged frame with the cylinder bored out to only ¾ inch in diameter. In place of the hand-fitted, leather-covered piston, a steel piston was used, precision machined to make a slip fit within the cylinder. Another improvement was the substitution of a machine-wound coiled spring, rectangular in cross section, for the two forged volute springs. Gallery guns were equipped with either detachable crank, trigger guard lever, or side lever for cocking; Quackenbush substituted the barrel itself for this purpose. In place of the various loading mechanisms needed, such as twisting, turning, or tilting, also positioning, and locking, there was substituted a simple milled slot which came into open position when the barrel was pushed in for cocking.

The result of these simplifications and improvements in design was the production of a gun that, while at least as effective as the hand-made gallery gun, could be mass produced at a fraction of the cost. In the 1873 catalog of the Great Western Gun Works (136, p. 17) there is found listed a gallery gun retailing at thirty-five dollars. Other contenders for the shooting gallery trade in the same catalog were guns employing cap and shot, at thirty-six dollars, and the French Flobert saloon rifle at fifteen dollars. The Quackenbush appeared on the market at ten dollars and was sold at varying prices, even as low as $4.35 in 1902 (213). Under this onslaught the gallery air gun gradually dropped in price and has not been found advertised after 1879.

From that time on Quackenbush rapidly assumed the leading position in the air gun field in America. However, even access to factory records does not make the picture too clear. A gentlemen's agreement often preceded the actual transfer of a patent, and guns invented and sold by others than Quackenbush are found in the production records of the latter's plant.

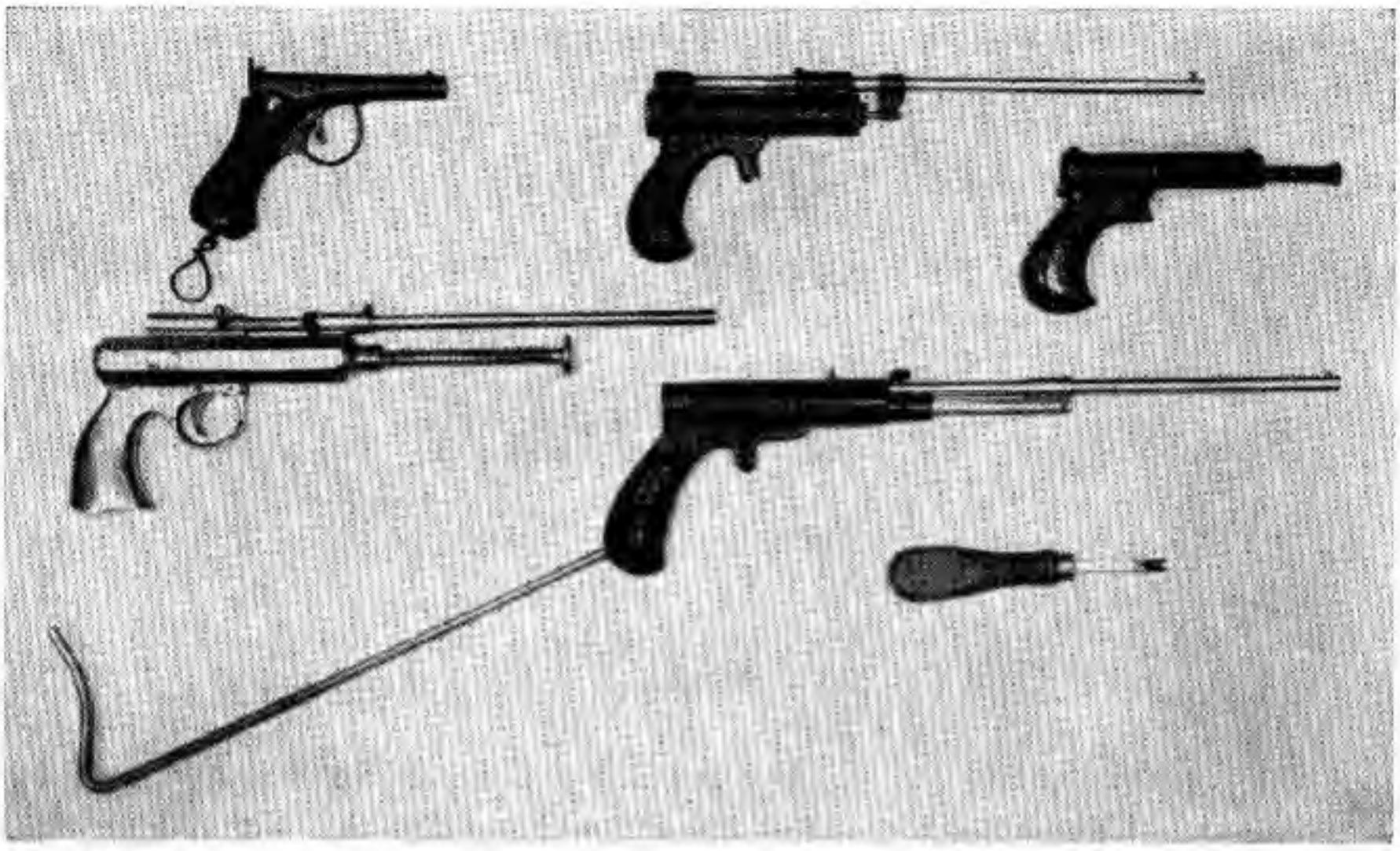

Fig. 35. Quackenbush and other Pistols.
Top row, left to right:

1st. The patent for this gun was issued May 21, 1872 (118) to Haviland and Gunn. The patent calls for a push-down compression of the wrist spring. The production examples have a butt ring for pulling the spring downward.

2nd. This is basically the Nov. 17, 1874 (192) patent, reissued March 7, 1876 (193), both assigned to Pope but probably produced by Quackenbush.

3rd. The top of the lacquered barrel of this pistol is marked "Pat. March 6, 1877." This is one of the Quackenbush patents (196) covering a push-in barrel which compresses the piston spring. Upon discharge the piston and breech move forward. Basically this example is similar to the original patents of June 6, 1871 (191) and June 6, 1876 (197), although the latter actually served as the base for the No. 1 air gun.
Bottom row, left to right:

1st. The patents for this pistol were issued to Augustus Bedford (16) and George A. Walker (233), they being variants of a mechanism in which the barrel and cylinder were pushed back to cock. Thereupon the barrel was returned to a forward position after which the piston could act. The bolt-action breech is a Walker feature which has carried over into modern forestock-pump varieties. This example does not have the barrel-plunger design, but instead has a separately acting plunger.

2nd. "Champion" air pistol, patented by Iver Johnson and Martin Bye (135). The barrel is unlocked at the breech and can then be tilted to form a "T," serving as a grip for pushing back the plunger. A dart extractor for use on the target accompanies the specimen.
(Neg. 203329)

One of these associations was with Pope of Boston who sold a pistol patented by Quackenbush (192; 193), and possibly manufactured by the latter (Fig. 35). This pistol was improved upon by one patented by G. A. Walker (233) of Boston, probably an associate of Pope's. The Walker patent also appears basic to the bolt-acting breech found on most modern forestock-pump guns. Pope was a bicycle manufacturer of some renown. He is shown seated on one of his high wheeled bicycles, sounding a hunting horn, on a photograph now in the Quackenbush archives. Pope's enterprise in Boston, which manufactured the Eureka pistol, was taken over, probably upon Pope's death, by Augustus Bedford, who

advertises himself on an undated business card as the maker of Bedford's Eureka air pistol. Bedford finally returned (or went) to work for Quackenbush and assigned the patent back to his employer.

Another of these relations was with Haviland & Gunn of Ilion and Herkimer, N. Y. Benjamin Haviland, then a resident of Hudson, N. Y., and George C. Gunn of Ilion, had secured a patent (117) for a parlor air pistol of the gallery type. This was the basic patent for the air guns that were cocked by the act of dropping the barrel for loading. Presumably these men were working for Remington, as a presentation specimen, made for one of the Remingtons, exists (Fig. 36). While the dropping barrel patent specifically covers air pistols, a rifle marked

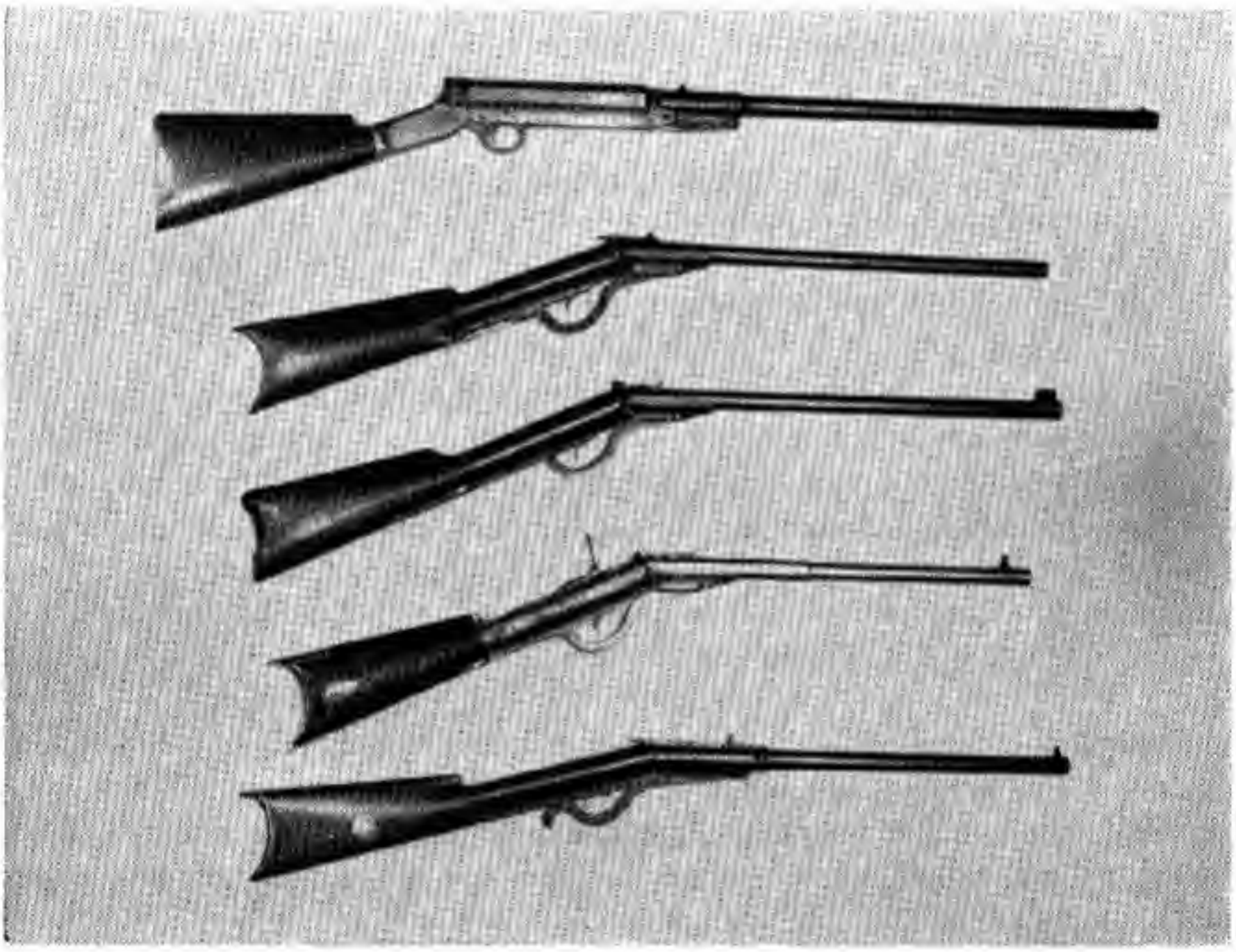

Fig. 36. Quackenbush and Haviland & Gunn Spring Guns.
1st. Haviland and Gunn. This is a break-down type with the spring and piston in line with the barrel.
2nd. Haviland and Gunn. Combination air and .22 rim fire. Shop number 5.
3rd. Similar to the previous. Shop number 20.
4th. Similar to the above. Remington presentation.
5th. Quackenbush No. 5. Combination air and .22 cartridge.
(Neg. 203330)

"Haviland & Gunn, Ilion, N. Y. April 18, 1871" exists, with the shop number 5 (Fig. 36).

The Haviland & Gunn firm evidently engaged in manufacture to some extent, also producing the "Hurricane Air Rifle" which was made under the pat-

ent of Asa Pettengill (185). This rifle was characterized by having the compression cylinder in the wrist of the gun instead of ahead of the trigger, resulting in a material improvement in the balance of the gun. On March 9, 1886, George Peck Gunn (111) combined the drop-barrel cocking mechanism with the noted cylinder in the wrist of the gun.

Some of these pieces were produced by Haviland & Gunn in Ilion, N. Y., before the patent was bought by Quackenbush. It is probable that the listing of Quackenbush as a gunmaker of Herkimer and Ilion has come about through the finding of Haviland & Gunn examples marked "Ilion," which were taken to be of Quackenbush manufacture. Four specimens of this variety are presently known, three with the serial numbers 5, 20, 7, and one without a number. It is interesting, incidentally, to note that the Gunn patent has a mechanism, geared to the forward end of the cocking lever, that feeds balls from a magazine. When Quackenbush purchased the patent and thereafter improved on it (194), this plunger mechanism was converted to serve as a cartridge ejector. Both the Haviland & Gunn and Quackenbush versions were designed as dual-purpose weapons to shoot .22 cartridges by having the head of the piston strike a firing pin placed in the air vent of the cylinder, a feature abandoned by Quackenbush in some of the later examples of this model.

When Quackenbush improved on the Haviland & Gunn rifle, his patent covered another feature of interest. This was a cocking link so hinged that, should the gun slip with the barrel in cocked position, the link would fly outward thereby lessening the danger of crushing the fingers between the link and the frame. As far as is known, this feature never appeared on any production model. These guns were produced by Quackenbush until 1907, and the last serial number assigned was 3185. Production had started in 1884.

In 1890 the trade was informed of the erection of a new factory, consisting of a four-story brick building, 47 x 113 feet. The building was a modern one and contained an automatic sprinkling system and an elevator. It appears, incidentally, that Quackenbush spent a considerable amount of time in an effort to make the elevator level off with the several floors.

Quackenbush produced eight major models of shoulder guns, seven of which were variations of the number one model, the one with the push-in barrel. These were known as models 1, 2, 3, 4, 7, 9, and 10 (Fig. 37). Model number 5 was the combined air gun and .22 rifle developed by Haviland and Gunn. Air gun number 7 was a sheet-metal product, really a BB gun, developed by Paul Quackenbush to meet the competition of Daisy, King, and others. By this time technical improvements had placed the H. M. Quackenbush Co. in very much the same position in which they had, years before, placed the makers of hand-made gallery guns. The air gun business of the company gradually diminished until at the time of Henry M. Quackenbush's death on September 8, 1933, apparently no new pieces were being made; existing stock was still being sold. It was not so much that the company could not compete with the makers of tin plate guns, as the fact

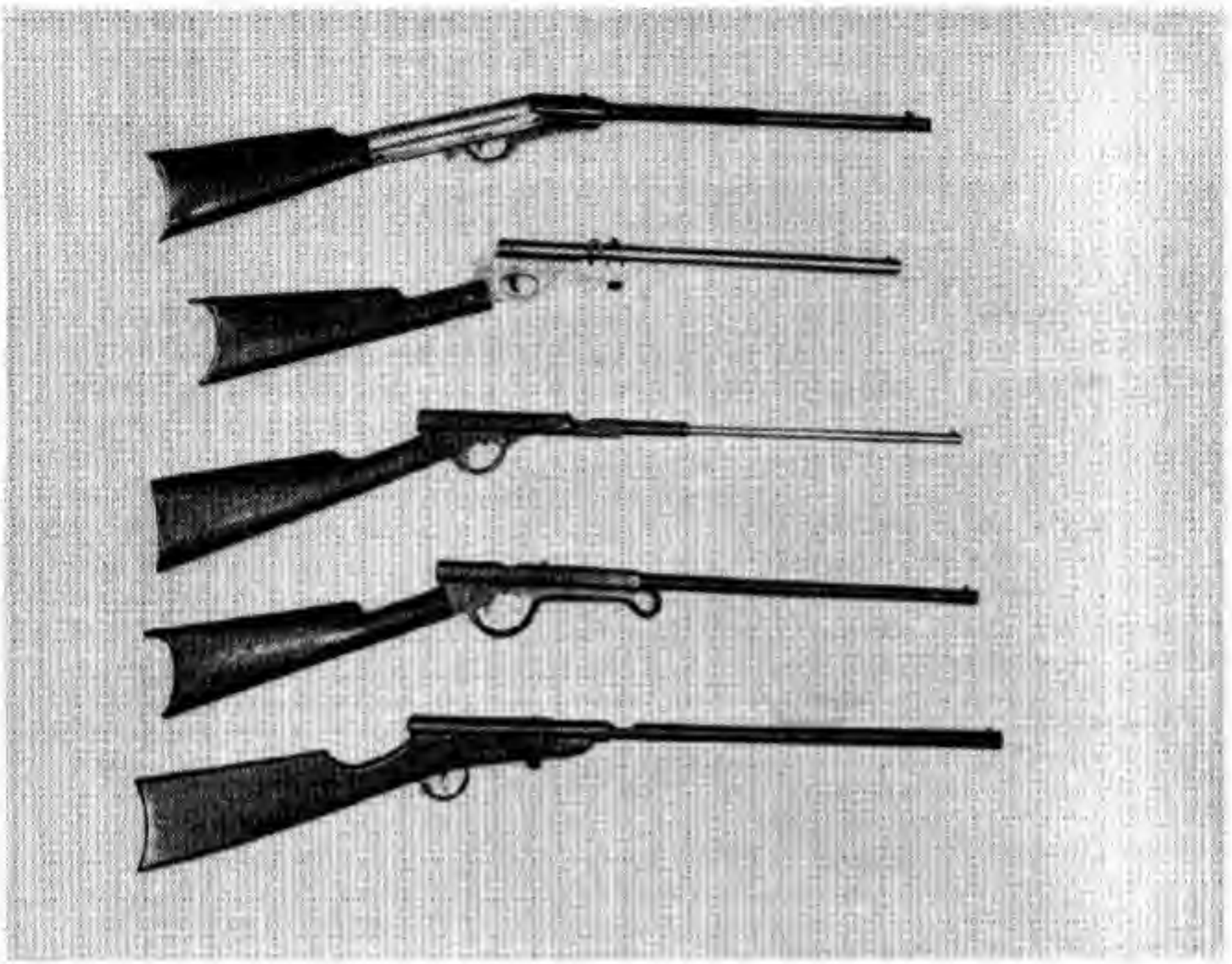

Fig. 37. Quackenbush and Foreign Spring Guns.
1st. European copy of Quackenbush by Coirier.
2nd. Quackenbush "Lightning" (piston cap missing).
3rd. Quackenbush No. 1.
4th. Quackenbush No. 2.
5th. Quackenbush No. 7.
(Neg. 203331)

that the plant was a modern and complete one, set up to do general machine work, screw machine work, wire forming, and plating. The result was that other products came along and absorbed the plant's capacity. The company thus remained in business, operating a modern plant, utilizing much of the equipment which had originally been built for air guns and, although there was no desire to go back into the air gun business, the family looks back with pleasure upon the early days.

Aside from the production models noted, Quackenbush, who appears to have been the first user of the wound spiral spring, was also interested in the rubber band as a substitute for the metal spring. This idea was used in the "Lightning" air gun, patented on July 22, 1884 (195). Of these, 354 were produced in the patent year. Production figures for the following year are not available, but the model was apparently abandoned as a failure.

An article by Harrison (106) is suggested as supplementary reading.

Tinplate

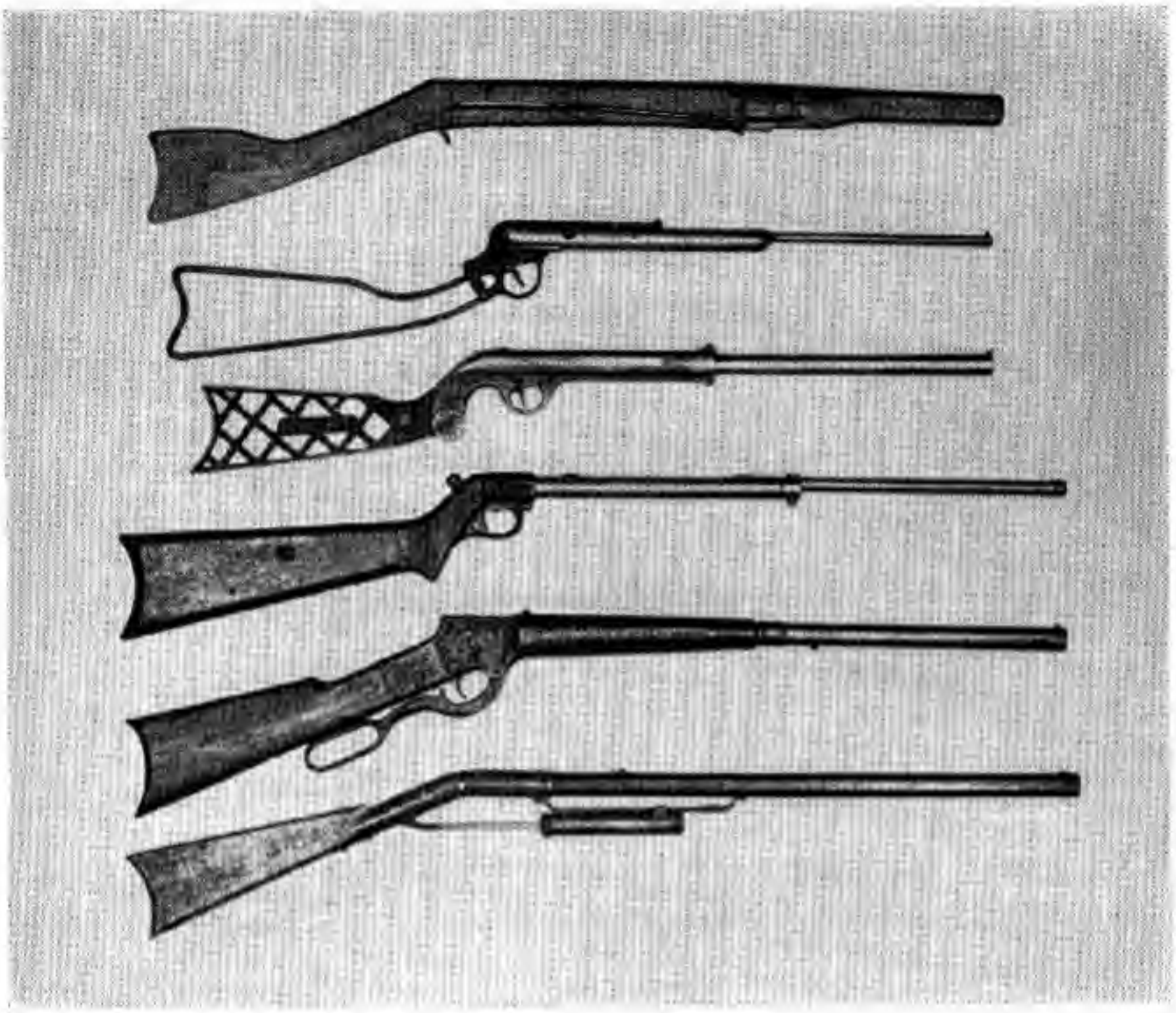

Fig. 38. Tinplate.
1st. Chicago air rifle.
2nd. Daisy. First model.
3rd. Globe.
4th. Matchless.
5th. Columbia, 1899.
6th. St. Louis air rifle.
(Neg. 203352)

If the reader has not yet become aware of the fact, this is as good a place as any to call attention to the lead which air gun makers had over gunsmiths. Not only are the advances in lock mechanics, breech-loading techniques, metallurgy, and appreciation of pressure evident, but the radically new process of using folded metal was also adopted by air gun makers as early as the 1890's. While it may come as a shock to firearms manufacturers and the military, air gun makers have been no less than fifty years ahead in production techniques. With the improvement in alloys and manufacturing technology, firearms can now be made almost as simply, although not as cheaply as BB guns.

In an issue of the Sporting Goods Gazette (219), dated 1889, there was advertised an even more primitive type of weapon than the tinplate. This was the "Challenge air rifle." Here Thorsen & Cassady, Chicago, Ill., gave a glowing account of their weapon in the following words.

"EVERY WIDE-AWAKE BOY in the country will want a Challenge air rifle. It is the latest thing out. Simple! Durable! Strong! It is the only air rifle made solid. No hinges or joints to get loose and out of line. The air chamber and barrel are of mandril drawn brass. Shoots BB shot, 100 shots for one cent. Price, $1.00. Here it is. Make no mistake!"

An archway loaded with sparrows, nests, and litter is shown also and is titled, "The English Sparrow in Modern Architecture. We furnish you the Remedy. Per dozen, to dealers only, $9.00."

The illustration accompanying the above shows an arm somewhat similar to the "Chicago air rifle," with solid frame, however, not hinged as is the Chicago. The latter was made by the Markham Air Rifle Company, Plymouth, Michigan, and is claimed to have been a forerunner of the Daisy.

The Chicago air rifle (Fig. 38) is a simple hinged board, cut into the approximate shape of a rifle, having a long wire staple attached which, when the arm was "broken," forced a spring back to a catch, meanwhile drawing back and holding a piston rod. Upon release, the rod was propelled forward, ejecting a BB pellet out through a folded brass barrel. The gun is identified (5) as " . . . probably the hardest-shooting spring air gun ever marketed." Frankly, such a eulogy, which is dated 1946, completely disregards all spring guns, both those prior to the Chicago and those from that date to 1946.

W. F. Markham (166) who patented the Chicago air rifle, has been credited with no less than eleven patents relating to spring guns. Subsequently a series of BB guns, including the Globe (221), the Matchless, an assortment of Columbias (7; 8; 9), the Quackenbush No. 7, and numerous other varieties appeared. To list them all would be an impossibility at present. Since 1900 the BB gun has appeared in an almost infinite assortment.

A unique example of a true air gun is included here, it being also a tinplate type. It is marked "St. Louis Air Rifle Co., and is believed to be the first model Benjamin. A bicycle pump that is worked on a rod, trombone fashion, pumps air through a brass tube to the reservoir in the wrist. The trigger is a clamp on a rubber tube, like that on a household syringe, and allows the pressure to escape for discharge when pulled free.

Tinplates offer a challenge to collectors inasmuch as the field is open and a never ending search can be promised. Boys have always been notoriously careless with their toys, and their BB guns have, as a result, a questionable survival.

European Pneumatic Arms, Introductory Remarks

The development of the complicated series of European pneumatic arms is founded upon two basic ideas, both of which progressed until, by a fusion of the best of their several principles, the ultimate in air guns was produced. In order to present the progression with as little confusion as possible, the story will be

divided arbitrarily into a number of sections. Admittedly, present opinions, based upon available specimens and other data, may be altered in the future if conflicting evidence comes to light.

One large group of pneumatics, that with butt reservoirs, may be the result of the work of Marin of Lisieux, whose gun is claimed to have been so designed (see p. 13). Regardless of ancestry, the series progressed on the continent until it migrated to England, where a fusion with other types occurred.

Another series appears to stem from the investigations of Otto von Guericke, the famous mayor of Magdeburg (see pp. 15–16). It took two forms, both of which also migrated to England where the desirable elements were incorporated with the presumed posterity of Marin, and a peculiarly English weapon was produced. One variety of the von Guericke group was provided with a globe or ball reservoir; the other had a cylindrical reservoir around the barrel.

The subject of the European pneumatics will not be treated exhaustively here, inasmuch as certain of them are known to us only through the older records. Inasmuch as an external examination will indicate the internal mechanism and, because it is not always possible at a given moment to more than casually examine a specimen, the point of view of a collector will be maintained in the classificatory and descriptive systems.

Butt-Reservoir Air Guns — Continental

OUTSIDE-LOCK GUNS

The outside-lock air gun is a unique device in more ways than one. It is the only type of air gun regarding which no contemporary references were ever made in Europe—at least none has been found. In fact, the only reference to this type, aside from a fragmentary one in French, of apparently recent date, is the one which is included in Appendix II (p. 143), the origin of which is Japan.

While there is no proof, it is presently suspected that the air gun that was so hopefully bought to destroy Cromwell was of the outside-lock variety. Reference is made to the seven shots with "one charging with wynde." The Kunitomo manuscript (referred to above), which described one a century and a half later, does not give the outside-lock gun credit for more than two shots with one filling, but fortunately does not leave a single question about its being an original outside-lock. The Kunitomo gun was formerly the property of Mr. Robert Kimbrough (141), who purchased the arm in Japan. What appears to be the original air gun from which Kunitomo copied his has also come to light. It was made, according to the mark on the receiver, by Scheiffel of Grave, Netherlands. This ties in with the statement that a Dutchman brought an air gun to Kunitomo, although the specific type of weapon was at that time no longer current. The fact that the gun brought to Japan was already old at that time may account for the limited efficiency attributed to it. What is not clearly stated in Kunitomo's notes is whether the gun was left with him. Inasmuch as it did not come to this country

from Japan, it is likely that the example was taken back to Europe after Kunitomo made his copy. That one is a copy of the other is not seriously questioned, inasmuch as the two are almost identical to each other and definitely not similar to any other outside-locks. Admittedly, Scheiffel may have made more examples according to a pattern, but in that case the end result would be the same: The Kunitomo piece was made in imitation of either the presently known Scheiffel gun or its twin.

We have no proof that there is any connection between Marin's gun and the outside-locks, but the area of production as presently determined would tend to substantiate such an hypothesis. While most of the pieces examined or otherwise encountered are unmarked, there is a sufficient number of name-marked specimens known to suggest a definite area of production. This area, as outlined on the

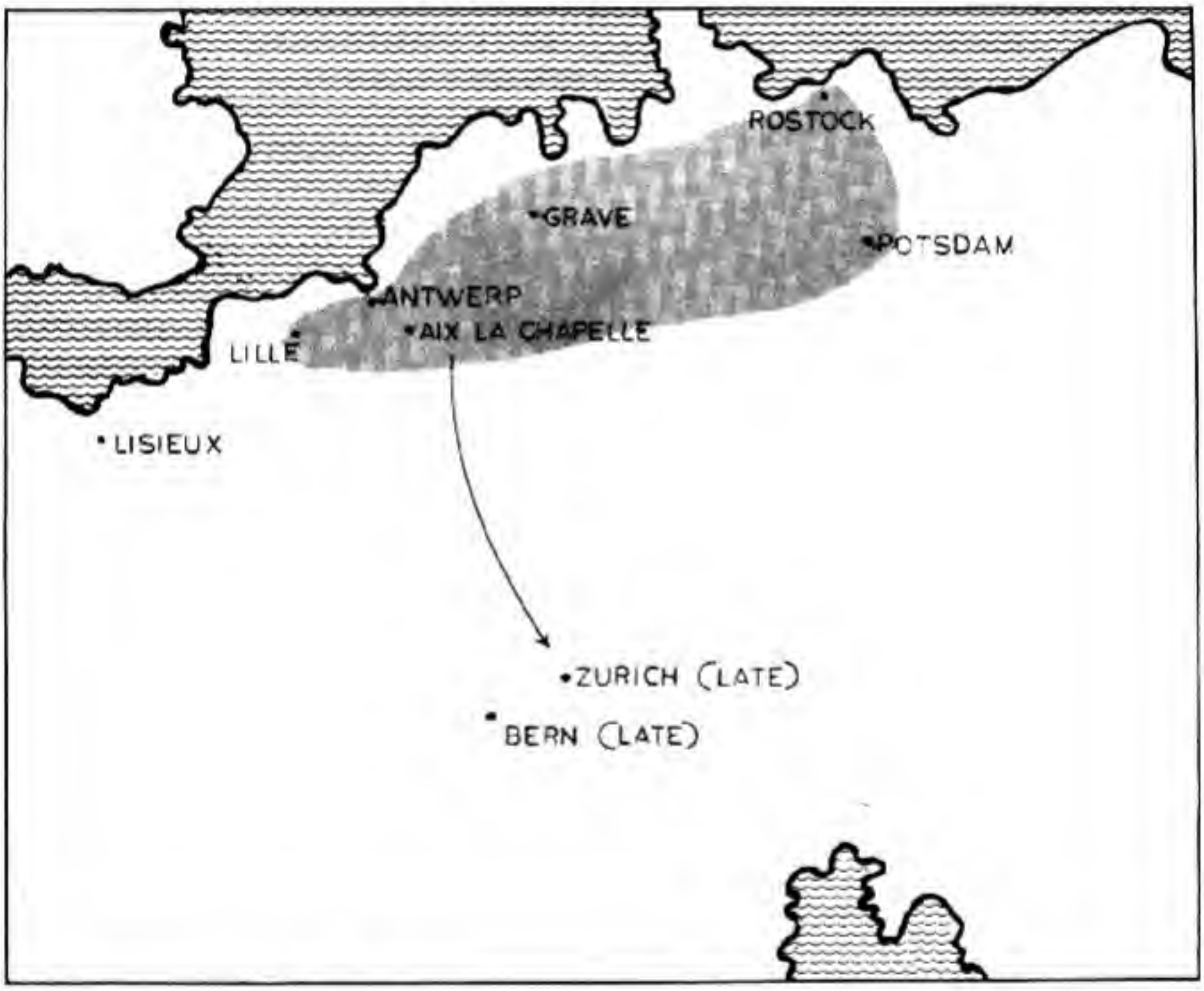

Fig. 39. Distribution of Outside-lock Air Guns.

accompanying map (Fig. 39), is strictly continental and substantiates also the theory that the outside-locks were the first development of what later may have become a transitional type; and finally without doubt the highly developed Austrian gun.

Along with the mechanical development there occurred also a migration southward, the details of which are developed subsequently. The outside-lock mechanism never migrated to England, although its apparent descendants did at a later

date. This fact substantiates our opinion regarding age inasmuch as known later-dated types did go to England.

By way of interpolation we present a thought that future study may substantiate. The remarkable similarity between outside-lock guns and fire lighters (Fig. 40) may mean more than coincidence, particularly in view of form and technique

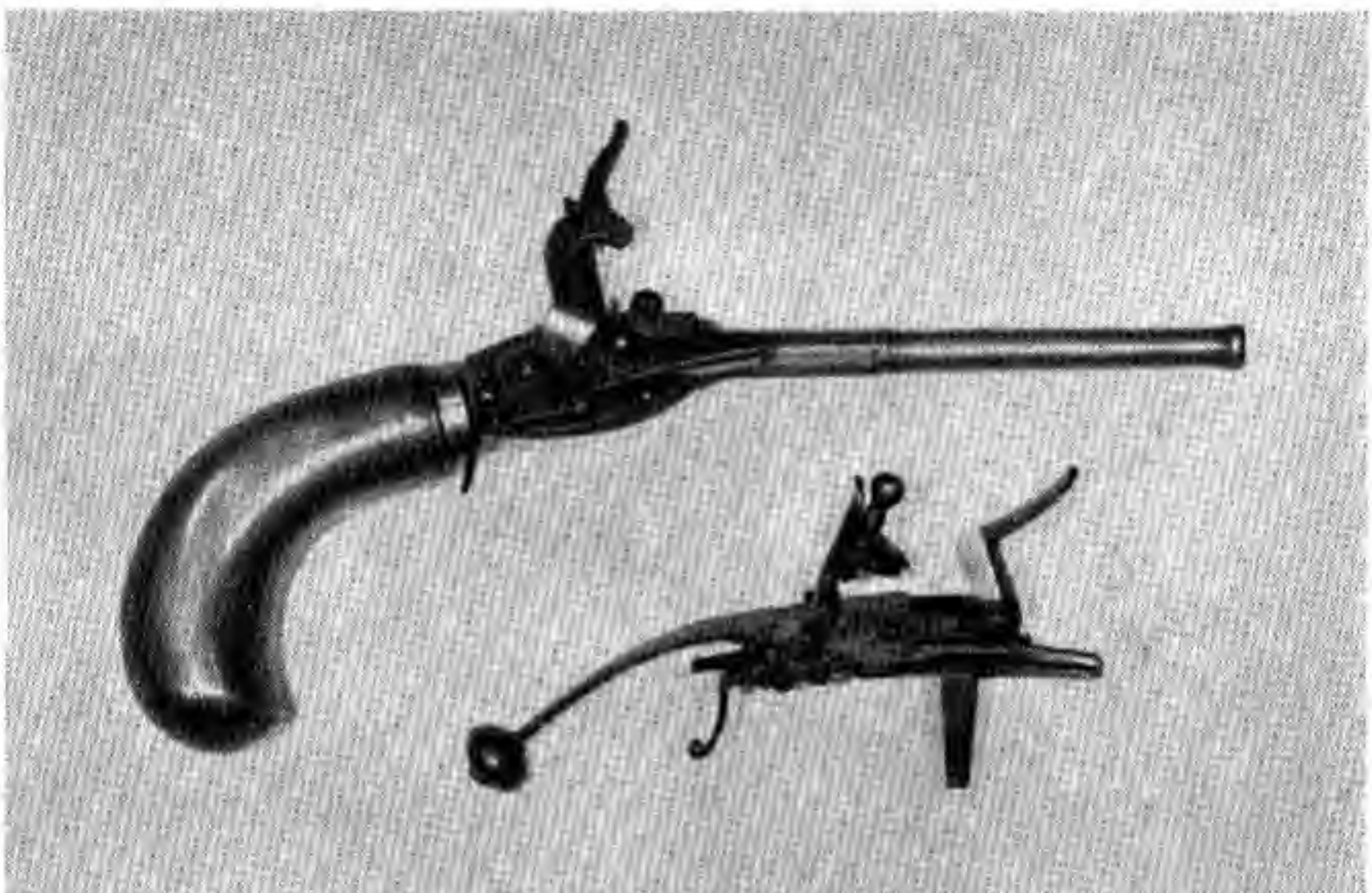

Fig. 40. Outside-lock Air Pistol, Fire Lighter.
(Neg. 203347)

of construction. Aside from this, we feel that there is a distinct possibility that flint-lock fire lighters, instead of being the children of flint-lock guns, are the parents.

One example of a flint-lock pistol, incompletely described (187, p. 44, item 14) appears to be similarly constructed. Its origin, oddly enough, is claimed to be Italian. The paucity of information regarding the specimen raises many questions, particularly the possibility of a southward migration of the outside-lock form.

In these cases one of the most obvious features is the externally-hung trigger. Other lock incidentals may be on the outer side of the plate, in fact, very frequently, particularly in the several forms of basic flint-locks, are; but externally-hung triggers are decidedly limited. Thierbach (228, fig. 164) calls such pieces Liege locks *(Lückerschloss.)*

Relative to the matter of names, a condition exists in the outside-lock story which is identical to that noted in the discussion on bellows guns. The names found on the specimens are not listed as those of gunmakers in any of the sources which we have been able to consult. As in the case of the bellows guns, the makers of outside-locks were apparently a craft by themselves and were not regular gunsmiths.

CHART SHOWING OBSERVED VARIATIONS, OUTSIDE-LOCK AIR GUNS

Name	*Striking point*	*Action location*	*Striker* location*	*Half Cock ?*	*By-pass*	*Other safety*	*Rear thread on receiver*	*Front thread on receiver*	*Bore*	*Collection*
	Above	Right side	Internal	Yes	Striker gate	None	Female	Male	Smooth	Nunnemacher
	Above	Right side	Internal	Yes	Striker gate	None	Male	Male	Straight rifling	Harrison
Scheiffel	Above	Right side	Internal	Yes	Striker gate	None	Male	Male	Smooth	Harrison
Kunitomo	Above	Right side	Internal	Yes	Striker gate	None	Male	Male	Smooth	Harrison
	Above	Right side	Internal	Yes	None	Hammer-striker blockade	Male	Female	Smooth	Harrison
Schaetter	Above	Both sides	External (bridge)	Yes	Pivoted block on striker	None	Male	Male	Smooth	Harrison
	Above	Both sides	External (bridge)	No	None	Hammer-striker blockade	Male	Male	Smooth	Nunnemacher
	Below	Right side	External	Yes	None	Hammer-striker blockade	Male	Male	Smooth	Nunnemacher
"Hill"	Below	Right side	External	Yes	None	Forward-locked striker	Male	Male	Smooth	Harrison
	Below	Right side	External	No	None	None	Male	Male	Smooth	Harrison
	Above	Right side	Internal	No	None	None	Male	Female	Smooth	Harrison
Frey	Below	Right side	External	Yes	None	None	Male	**	Smooth	Stich
Schenk	Above	Right side	*** Internal	No	None	None	Male	**	Polygroove rifling	Stich

* Striker=the intermediate member between "hammer" and rear-acting pin.
** Disassembly is impossible without damaging specimen.
*** All parts except hammer are internally hung.

The classification of the outside-lock air guns presents a problem unique in the field of arms. There are so many details which can readily serve as bases for classification that the problem appears, at first blush, to be very simple. The complexity of the details, however, makes it difficult to do more than describe the possibilities and leave the matter of a fixed system of classification for some day in the future when a larger series becomes available. The complexity also indicates that the weapon was in its formative, uncrystallized period.

One of the most obvious features is the location of the contact point between hammer and striker, it being either above or below the striker pivot. Also there is the possibility of an open or a closed bottom to the receiver. In addition to these features, one notes that the locks may be either on the right side or partly on both. Safety features and mechanical by-passes may also be present. The details are tabulated on the accompanying chart.

From this it would appear that, while there are obvious groupings in certain features, the features themselves are not at all consistent in the series. One would expect that, inasmuch as the striking point falls into a pattern, the action location would follow—which it does not! In the case of the striker location,

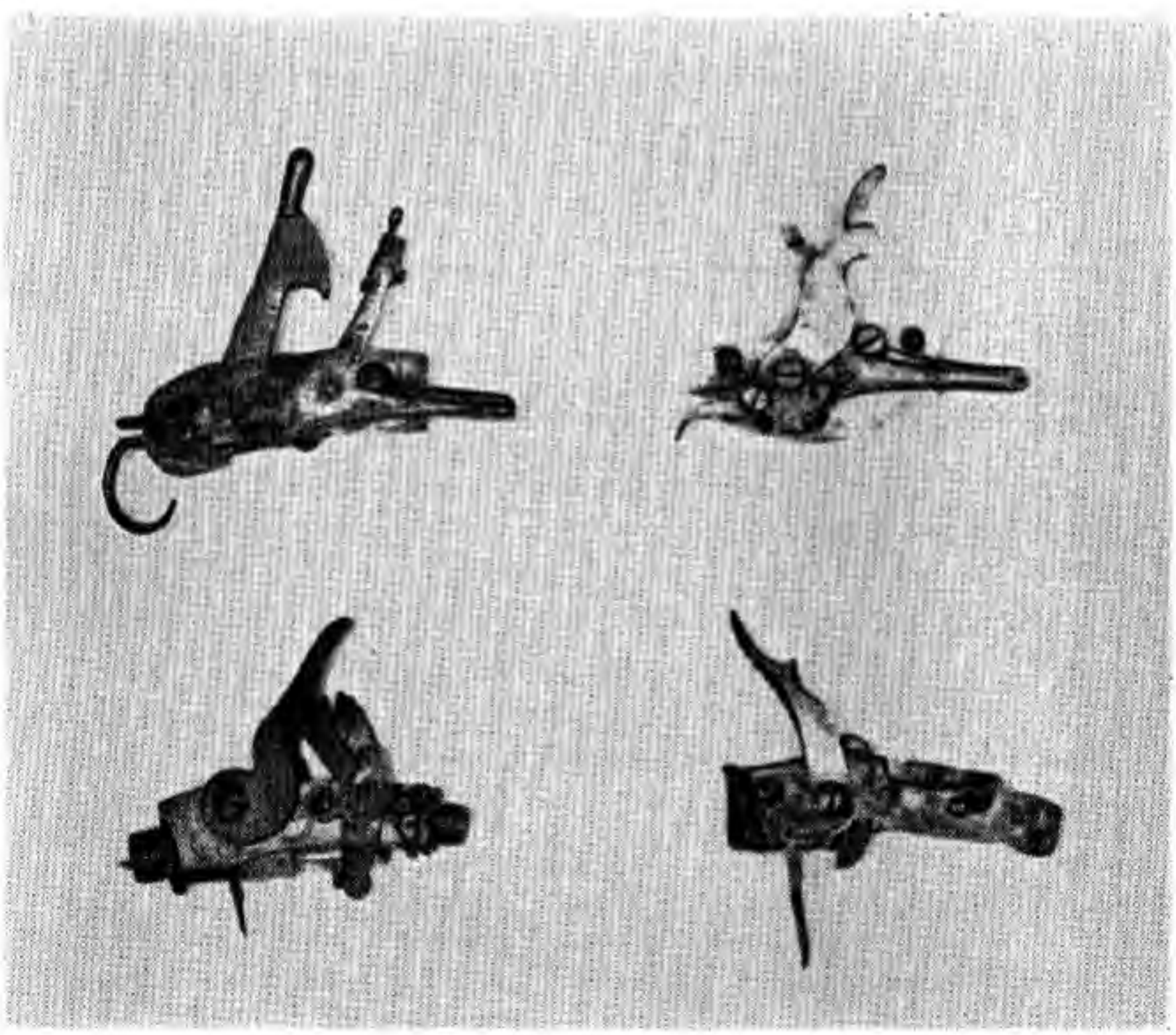

Fig. 41. Locks. Essential Types.
(Neg. 203343)

there is a semblance of order. Those which have the striker point above fall into two groups: internal striker, similar to a box-lock; and external striker, held by a bridge. All the examples which have the striker point below have external strikers, pivoting on screws. Half-cock notches approach being the rule. Confusion is again evident in the matter of the by-pass, in which either none is present or else one of two types is used. Uniformity is present in this matter only in the cases of the specimens that have striker points above and are open-bottomed, and in the cases that have striker points below. There is no uniformity in the matter of other safeties (Fig. 41).

The question of safety of outside-lock guns is a moot one. Were one to say that the presence of a half-cock constitutes safety, then nine of the thirteen observed specimens are safe. However, there enters the matter of the striker that can be moved forward without the action of the hammer. A desirable position of the hammer and striker is one in which the hammer is at half-cock (presumably safe) and the striker at the same time so blocked by the hammer that it cannot move forward and open the reservoir. Such a position is not possible in the specimens that have side-swinging gates or lifting bars on the strikers. While, on the other hand, such is possible in cases of meshing hammer and striker blocks, it is not always present.

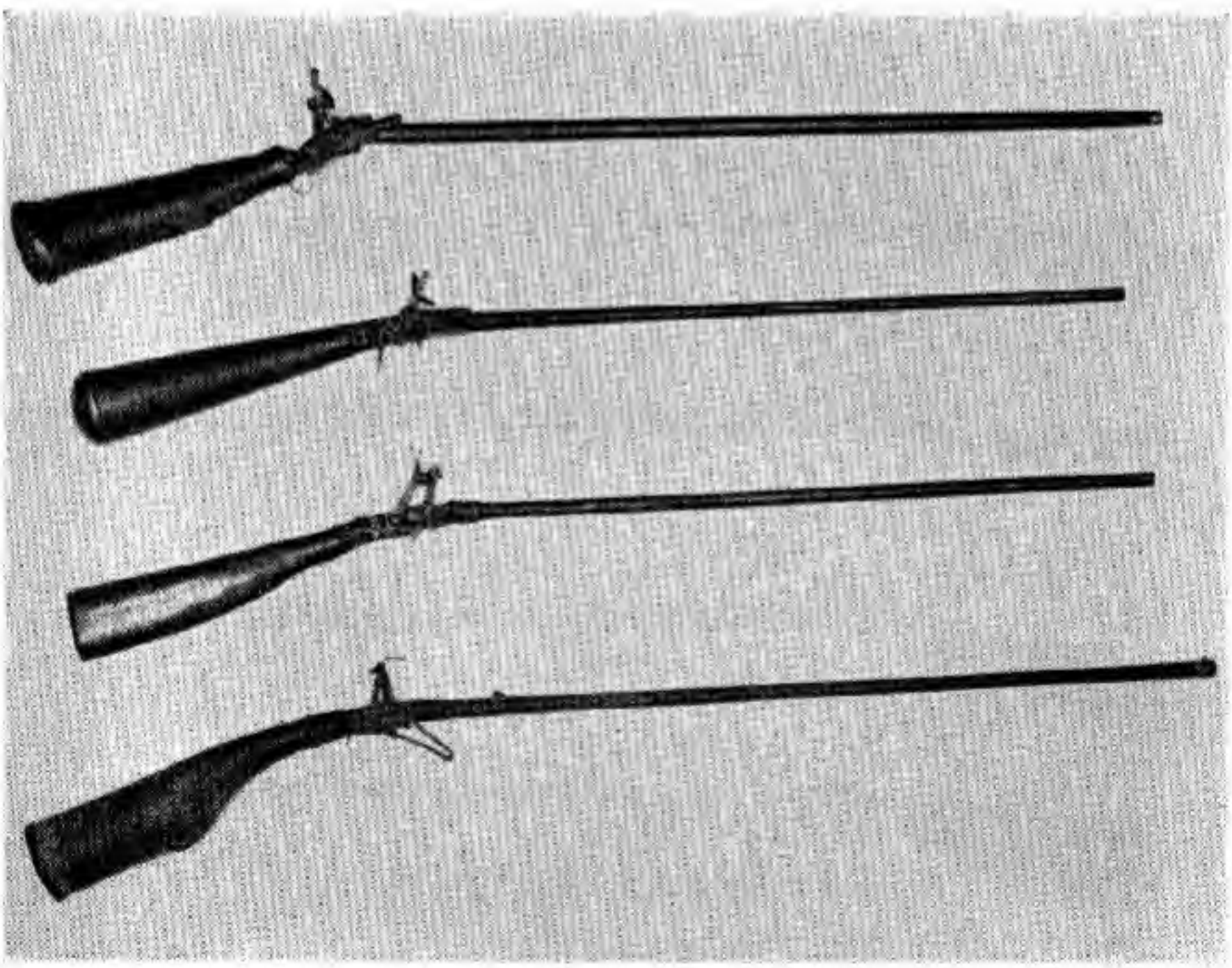

Fig. 42. Outside-lock Air Guns.
1st. Unmarked.
2nd. Unmarked.
3rd. Scheiffel.
4th. Kunitomo.
(Neg. 203344)

Perhaps one should be tolerant of these examples, realizing that they were evolving and, instead of being clearly a type of air gun with definite detailed characteristics, were a mechanical item in a condition of developmental flux.

Outside-lock air guns, therefore, are nothing more than that, the details of mechanism including potentially almost any combination.

Generally an outside-lock gun consists of a butt, a receiver, and a barrel. In the observed series of thirteen specimens (Figs. 40, 42, 43, 44), only one receiver has a female thread for the attachment of the butt, all others having male threads. The receiver threads which form a union with the barrel are in all but two cases male. (Two are not determined due to construction.)

In the observed series, four specimens have leather-covered butts. Possibly more did in the past but, old and dry leather being a friable material, it could break off with time. The butts vary in size, shape, material, and technique of construction. Valves are not in good order in the specimens at hand, but appear to be invariably made of leather, either long and conical or else rounded and rather globular. It is hoped that the valve structure and the housing for it may in time, when a larger series of specimens is available for study, become the definite basis of a system of dating. While we presently favor the long, conical valve as the oldest, we are not prepared to arrange the varying degrees of shape change into a positive chronology.

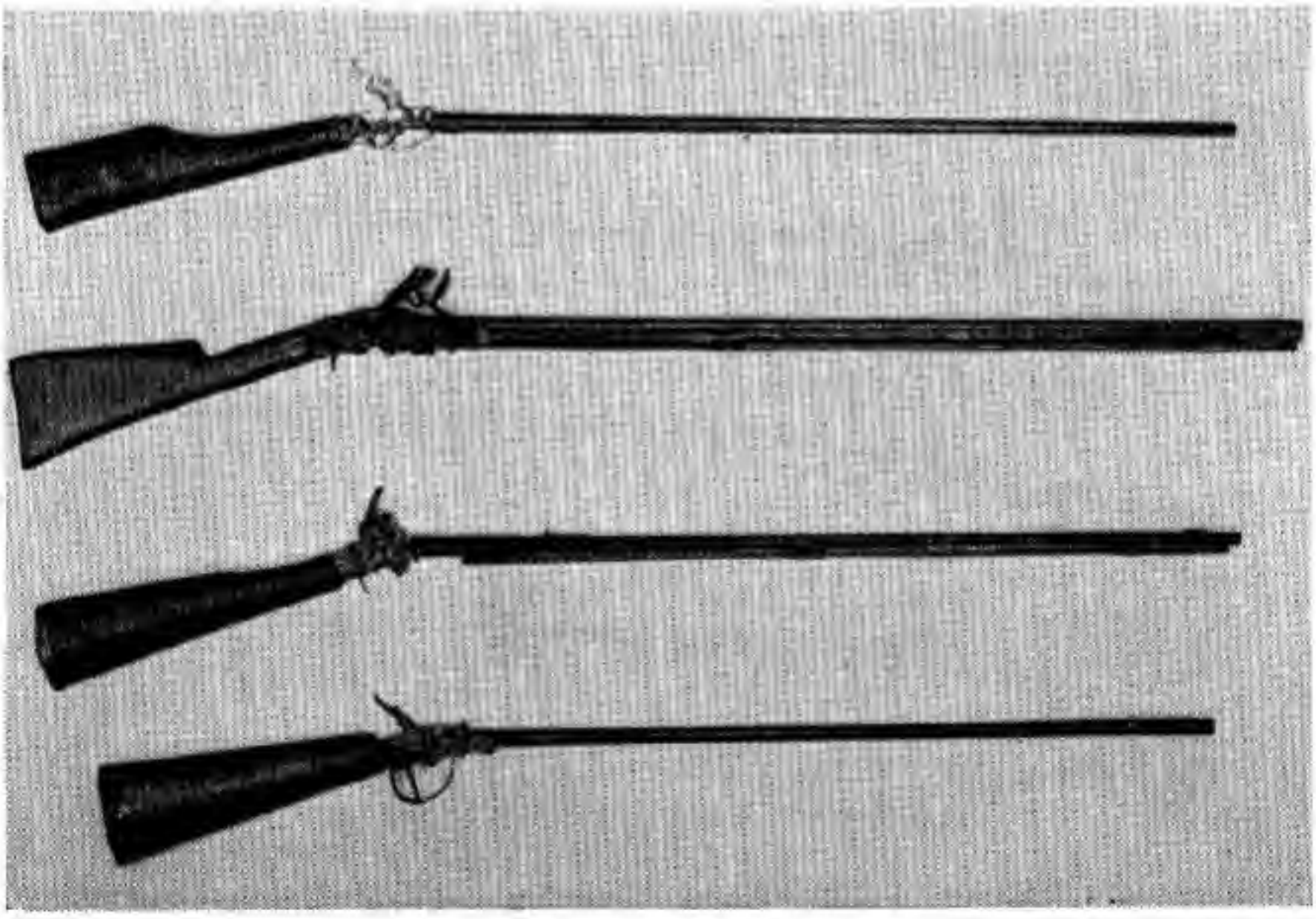

Fig. 43. Outside-lock Air Guns.
1st. Unmarked.
2nd. "Hill."
3rd. Unmarked.
4th. Unmarked.
(Neg. 203345)

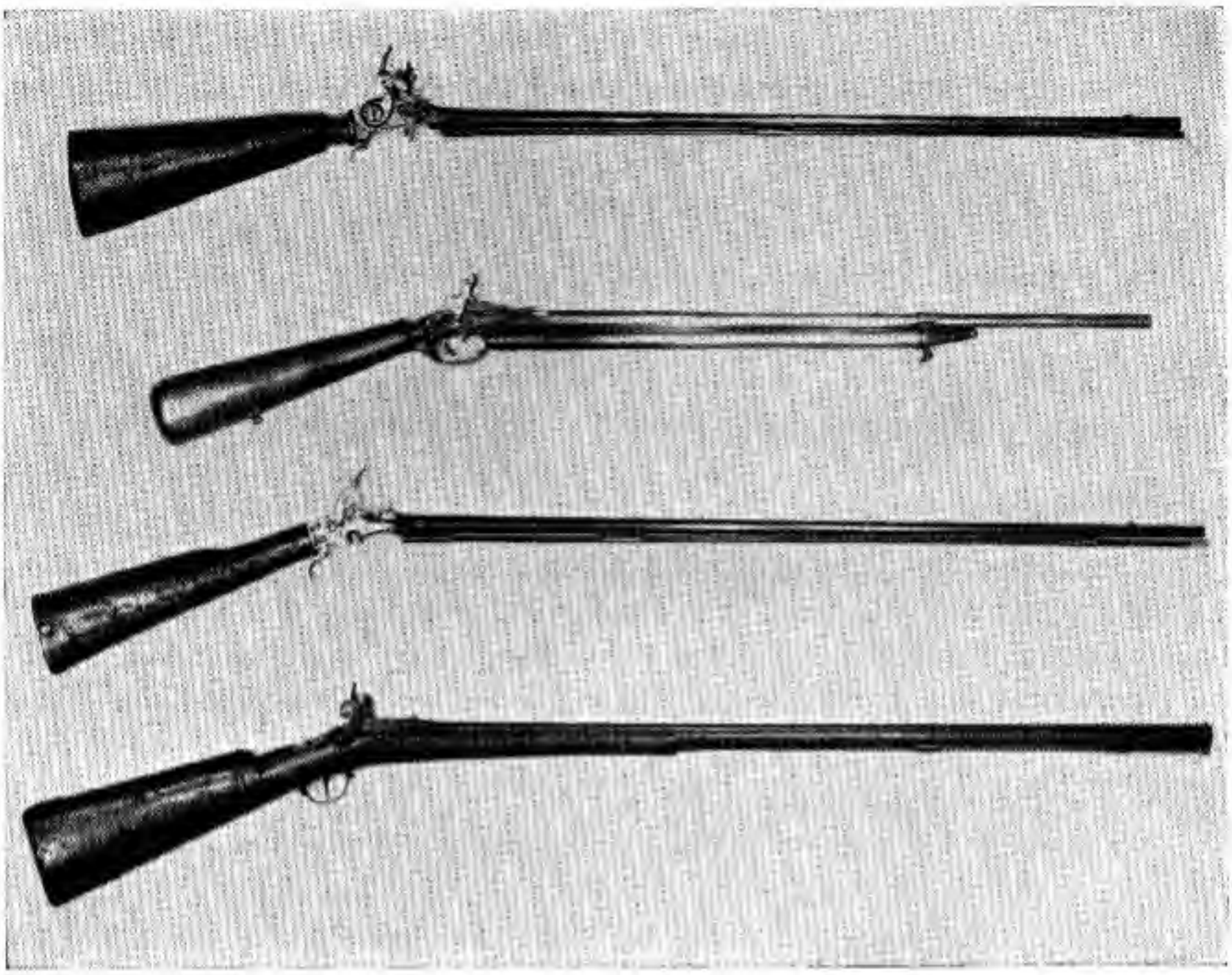

Fig. 44. Outside-lock Air Guns.
1st. Schaetter.
2nd. Unmarked.
3rd. Frey (from the Stich Collection).
4th. Schenk (from the Stich Collection).
(Neg. 203346)

Receivers vary in material and construction. They may be made in any manner desired as long as there is a tube present for the passage of air, and also a means of attachment for the lock. One receiver in the series is cast of lead inside a brass shell; others are built up of iron or brass plates; some hollow, some filled—one with a resin.

Barrels are often second-hand. Some have plugged hold-down slots, some have ramrod thimbles, many are lined with brass, all but two are smooth bores, one is wood-covered, and one was originally, according to the Kunitomo manuscript, leather-covered. The longest barrel is 37¼ inches; the shortest, 29½ inches, with an average of about 34 inches. Sights are generally nonexistent, although several barrels are optimistically fitted with very fine sets.

With the number of outside-lock air guns that has come to our attention during the last few years, we have altered our previous opinion regarding the great rarity of the type, but are not in a position at present to suggest the number that may still survive.

The following names have either been found on outside-lock guns or have been so associated with them as to suggest them as makers.

BESCH. ANTWERP, BELGIUM

An example by this maker has been found described and was reported to us by Harry Wandrus (239). No date is assigned.

FREY, JOH. HEINRICH. ZURICH, SWITZERLAND

For a product by this maker, see Fig. 44. From the Tom Stich collection.

HARTWICH. POTSDAM, GERMANY

This name occurs on a specimen that is not currently available (142).

KUNITOMO, FUJIHYOE. GOSHU, OMI, JAPAN

A descendant of a family that had been active as gunmakers for over three hundred years (141). He is the author of the Japanese text on outside-lock air guns in Appendix II (Page 143). He appears to be the maker of the Japanese product that is indicated as a copy of one by Scheiffel (Fig. 42).

NEUBECKER. LILLE, FRANCE

An outside-lock gun is reported as being marked "Neubecker a Lille" (77).

PARY, P. F. AIX-LA-CHAPELLE, GERMANY

An outside-lock gun is reported as so marked (250).

RASCH, M. H.

This name occurs on an outside-lock gun, engraved on the top of the iron receiver (1).

SCHAETTER, A. ROSTOCK, GERMANY

For a product by this maker, see Fig. 44.

SCHEIFFEL. GRAVE, NETHERLANDS

For an example by this maker, see Fig. 42. This piece is believed to be the original from which data were taken for the Japanese report, and is believed to have been the model for Kunitomo's copy. See Appendix II (Page 143).

SCHENK, G. BERNE, SWITZERLAND

An example by this maker, from the Tom Stich collection, is shown in Fig. 44.

TRANSITIONAL OR CONCEALED VARIETY

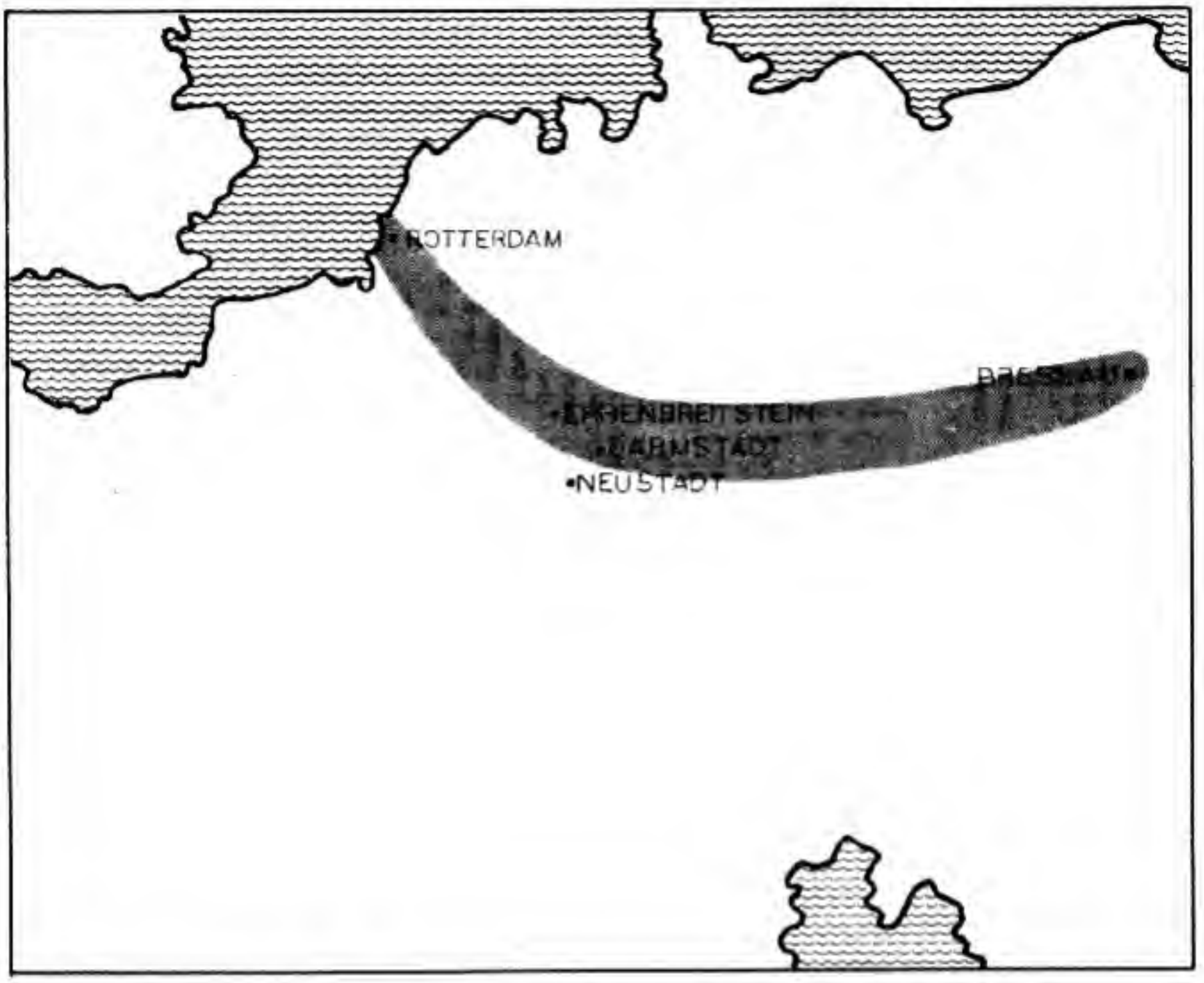

Fig. 45. Distribution of Transitional Air Guns.

It is probable that collectors will most readily recognize this type from the simple statement often encountered in catalogs: "Combined flint and air gun." The error is understandable inasmuch as the locks employed are either true and complete flint-locks or wheel locks. Internal additions and alterations, not visible externally, render the normal-appearing ignition unnecessary, but permit the lock to activate the valve in the concealed butt reservoir. The reservoir is more or less cylindrical and is carefully fitted within a normal wooden butt stock. It appears that the stock may either be hollowed out to receive the reservoir, or be split and fitted over it. Normally the pump is attached to the reservoir through a trap door in the butt plate.

There have been available for examination only two examples of the transitional variety of air gun, a flint-lock by Mouchin of Rotterdam (Fig. 46) and a wheel lock by Wentzlav of Ehrenbreitstein. In agreement with the Mouchin piece, according to descriptions or illustrations, are guns by Boslar of Darmstadt and Kuhlmann of Breslau. Questionable in the series is an item by Haas of Neustadt. It is claimed (41) that the latter has a butt-reservoir which unscrews and, when on the gun, is covered by two hollowed-out half-stocks; in other words, a modification of the same basic type as found on the outside-locks as well as on the

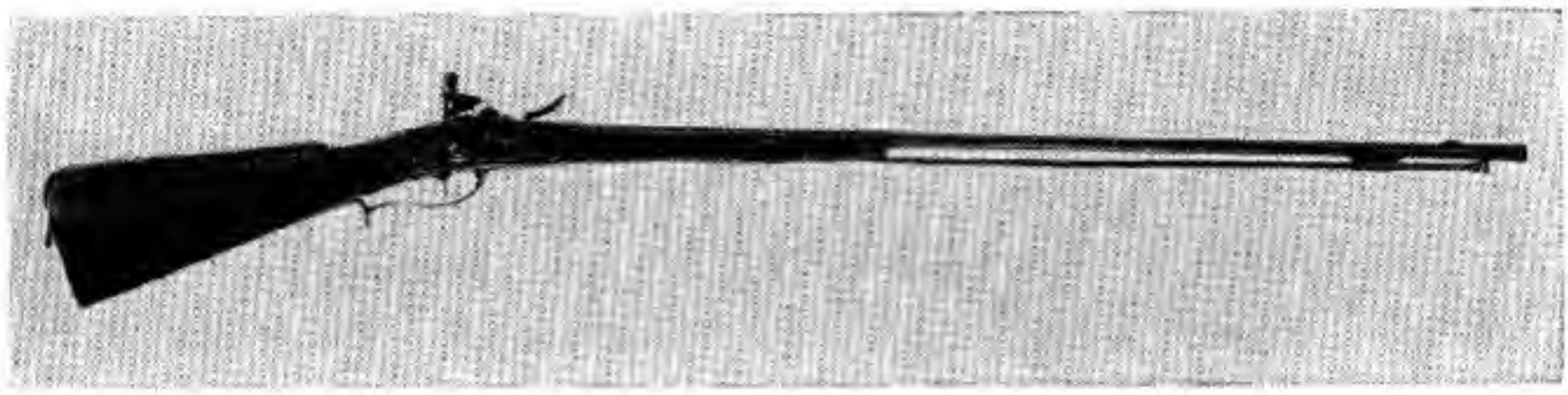

Fig. 46. Transitional Air Gun. By Mouchin.
(Neg. 426126)

later Austrian variety. The position of this piece in the series is not determined at this time, the concealment of the reservoir being the only reason for mentioning it here.

In the Mouchin specimen the lock principle is identical with the bottom-striking outside-lock, in spite of the concealment. The valve structure cannot be determined due to the fact that the wood of the stock has shrunk to the point where the removal of the reservoir would seriously injure the specimen, if not ruin it entirely. This is one of the few instances in which it has been impossible to satisfactorily analyze a specimen.

The example by Wentzlav is different both in appearance and operation, and leads one to wonder about the other examples that have been mentioned but not described in detail. In this case a sliding button in the butt plate allows a trap-door to spring open. A pump can then be screwed on. The patch box on the right is a dummy. The wheel serves to discharge the weapon, operating with a sort of camming motion. The cock serves no purpose. Double-set triggers are present.

In the preceding case of the outside-locks and also the Austrian types that will follow, there is only one valve in each reservoir. In what we have arbitrarily classified as a transitional or true concealed air gun, two valves are present. One is for the passage and internal retention of the air as it is pumped into the container. The other is the exit valve actuated by the lock. The input valve is exposed when the trapdoor in the butt plate is opened. In this type only, of all the varieties of butt-reservoir air guns, are two valves needed.

The lock on the Mouchin piece is a true flint-lock, altered by certain additions. What might lead a casual observer to think that the specimen is truly a combination flint and air gun, aside from the external appearance of the lock, is the presence of a touch hole at the proper place next to the pan. The opening is, however, only a simulated one and does not penetrate to the bore. The gun is a normal muzzle loader and is accompanied by a ramrod. The same can be said of the Wentzlav example.

The question arises whether this type of arm is responsible for the occasionally encountered rumors about noiseless and smokeless powders in the old days. To the uninitiated this type of gun could conceivably be loaded with a powder that answered such a description. While there is a sound of discharge, by comparison with that engendered by gunpowder it does not exist.

The following makers have been found as actual or possible producers of transition air guns.

BOSLAR. (Bosler) DARMSTADT, GERMANY

A number of references to this maker are at hand. Quoting from Hofmann (123) "Besides I own a few more specimens of old wind-guns, one of these from about 1725 with flintlock lock. This kind is signed by the famous German wind-gun-smith F. J. Boslar, Darmstadt, who was the gunsmith of the Landgrave Ludwig VIII of Hesse, the latter owning eighteen different wind-guns and with them shooting deer, wild boar, roebuck, and small game, *at great distance,* as it is proved and written in the special literature." Stockel (224) lists Bosler (Bossler), J. Philipp, Darmstadt, born 1731, died 1793. There may be confusion between several Boslars as is suggested by the differences in dates. Quoting from Ffoulkes (80), "715—Combined Air & Flintlock Fowling Piece (German, Middle of XVIIIth Century), with brass furniture decorated with huntsmen, deer, etc. The barrel, rifled with eight grooves, is marked BOSLER A DARMSTADT. The air chamber is in the butt, the plate of which has a nozzle for attaching an air pump. The two actions have separate triggers, that for the flintlock having a safety catch. Barrel, 38 in. Calibre, .47."

HAAS, I. NEUSTADT, GERMANY

Stockel (224) dates this maker as circa 1750. The only other reference to date is the following (41). "AIR GUN, German, 18th Century. Octagonal barrel with brass sight. It is decorated at the breech and at the muzzle with inlaid scroll work and is marked I. HASS IN NEUSTADT. Falsified lock plate with cock and lock. The compressed air reservoir is in the stock, which is unscrewed to receive the charge of air; it is concealed by two half-stocks hollowed out of wood which are assembled one on the other by the butt plate and by a brass ring underneath the trigger guard. The stock is decorated with scroll work, carved in the style of Louis XV and the furniture, bands, trigger guard, screw plate, butt plates, etc., are of sculptured brass. Length 45.4 inches."

KUHLMANN BRESLAU, GERMANY

Feldhaus (79) lists the following air guns in the possession of the Berlin Arsenal. "Kuhlmann of Breslau, 1st. half of the 18th. Century, caliber 8.7 mm. . . . Besides these the Zeughaus has also two air pistols, calibers 9 mm. and 10 mm., the latter from Kuhlmann, in Breslau, 1760." Dr. Hoopes (126) noted a splendid German flint-lock hunting gun by Kuhlmann. The cock had two springs, one on each side of the lock plate. There was also an indicator showing how many shots remain in the reservoir. This gun was on the antique market in Germany in 1930, but its present whereabouts are unknown.

MOUCHIN ROTTERDAM, NETHERLANDS

Nothing has been discovered regarding this maker aside from the gun marked with his name (Fig. 46).

WENTZLAV EHRENBREITSTEIN

Aside from the existing specimen and one reference, nothing is known about the maker. (The pump is with the arm.) Stockel (224) lists "Wentzlau (see Wentzlav) Ehrenbreitstein and Coblenz, c. 1725–c. 1750."

AUSTRIAN BUTT-RESERVOIR AIR GUNS

Here we have the ultimate in the development of the butt-reservoir air gun of continental variety. It, along with the addition of the Austrian Girardoni magazine, migrated to England where Staudenmayer produced an identical type. The production ceased on the continent and the British product was incorporated with other continental forms, also imports, until a distinctly English variety was developed.

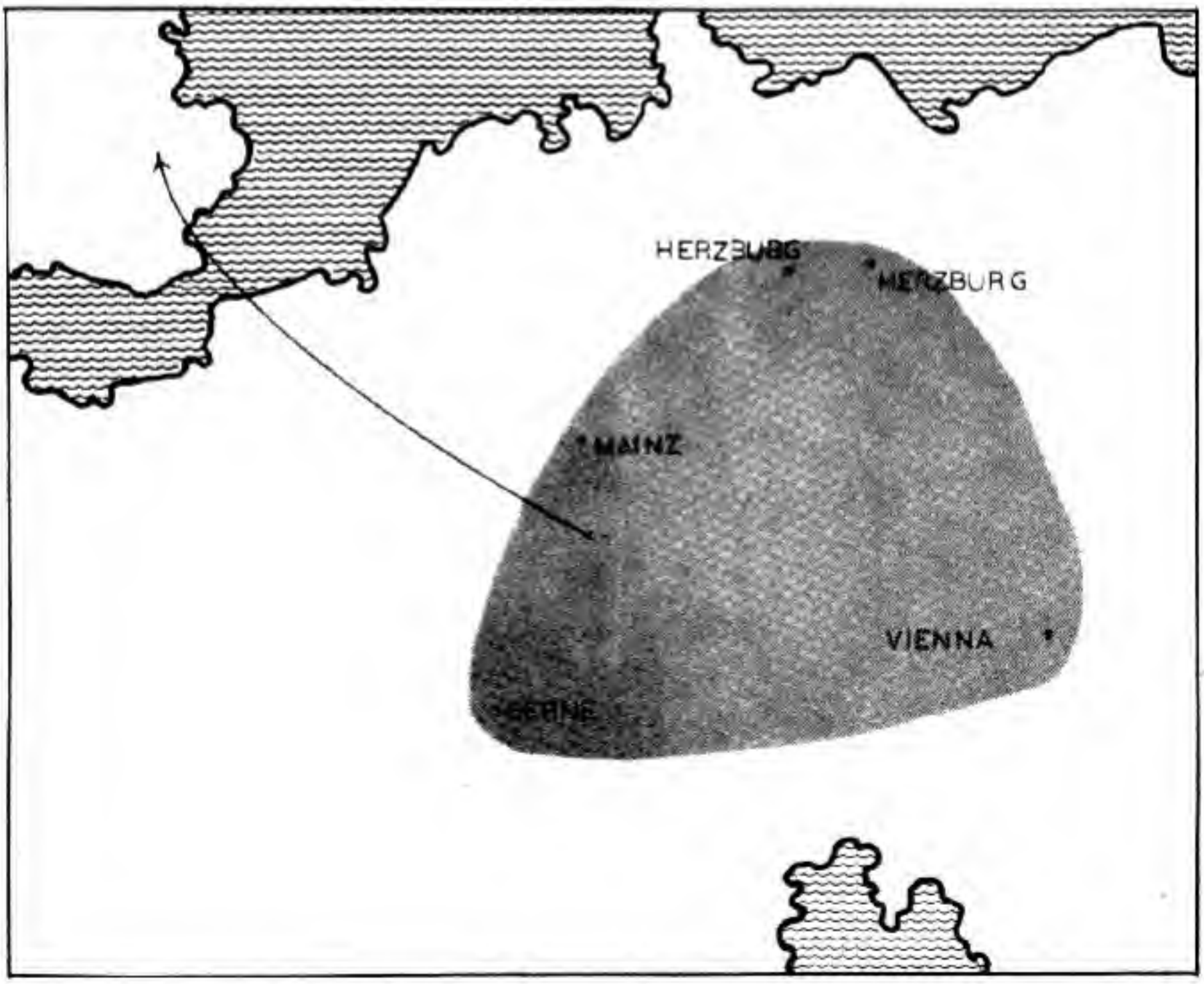

Fig. 47. Distribution of Austrian Butt-reservoir Air Guns.

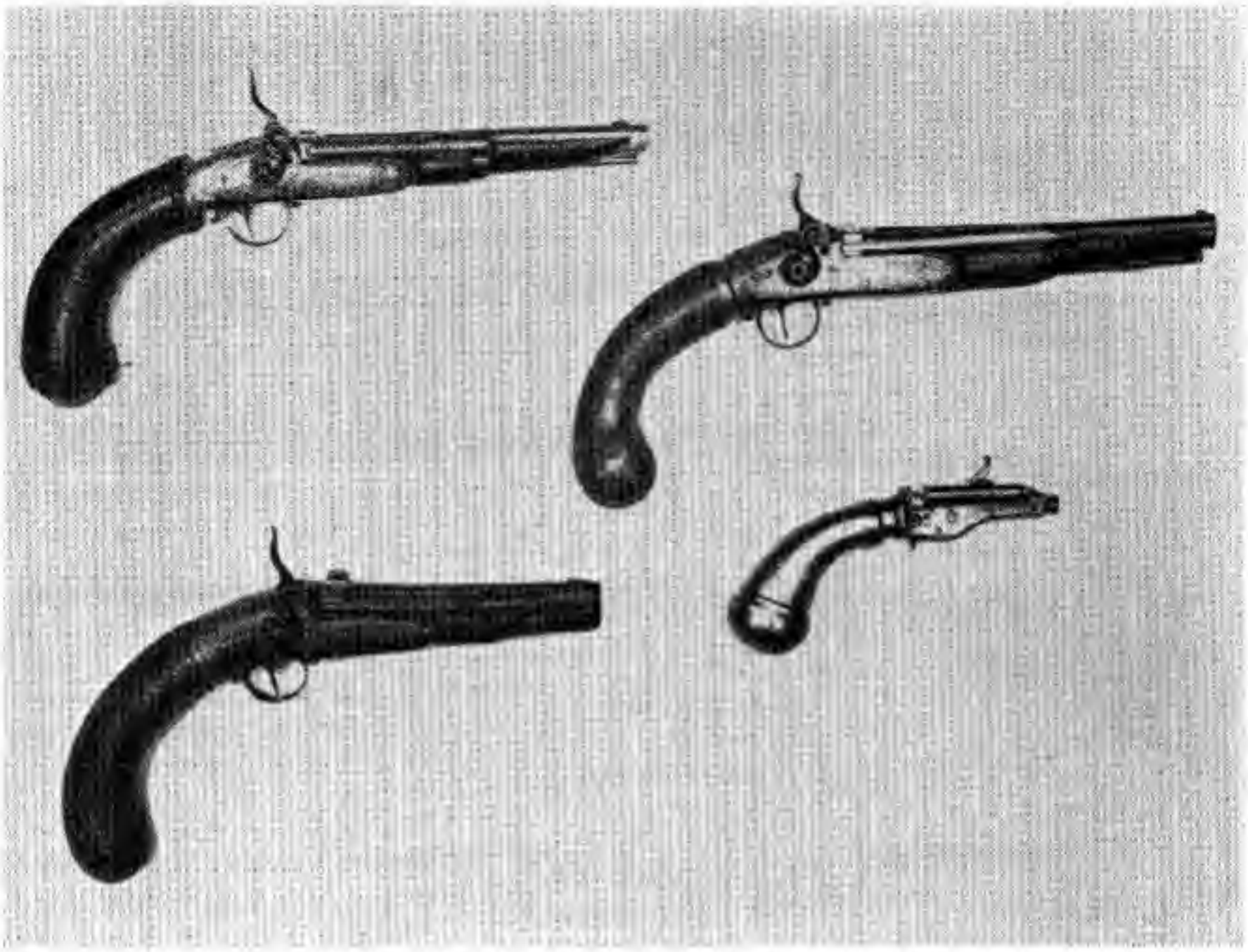

Fig. 48. Austrian Butt-reservoir Air Pistols.
Upper left: Girardoni.
Upper right: Oesterleins.
Lower left: Fruwirth.
Lower right: Unmarked variant with brass frame and reservoir.
(Neg. 203340; upper right, Nunn. No. N10861)

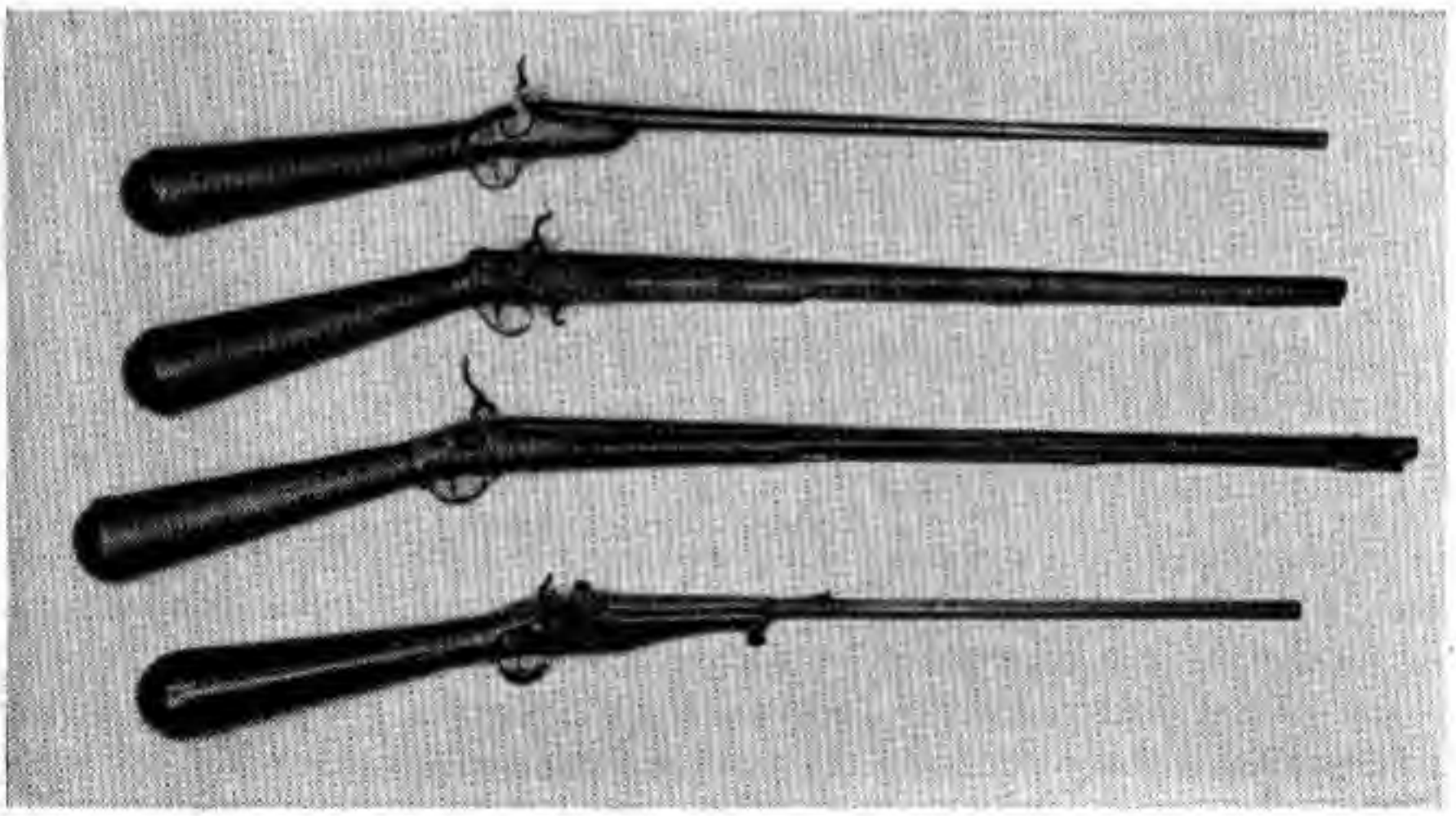

Fig. 49. Austrian Butt-reservoir Air Guns.
1st. Unmarked "primitive" rifle.
2nd. Wolf shotgun.
3rd. Contriner rifle.
4th. Contriner rifle with magazine.
(Neg. 203342; 1st., Nunn. No. N2826; 3rd., Nunn. No. N7136)

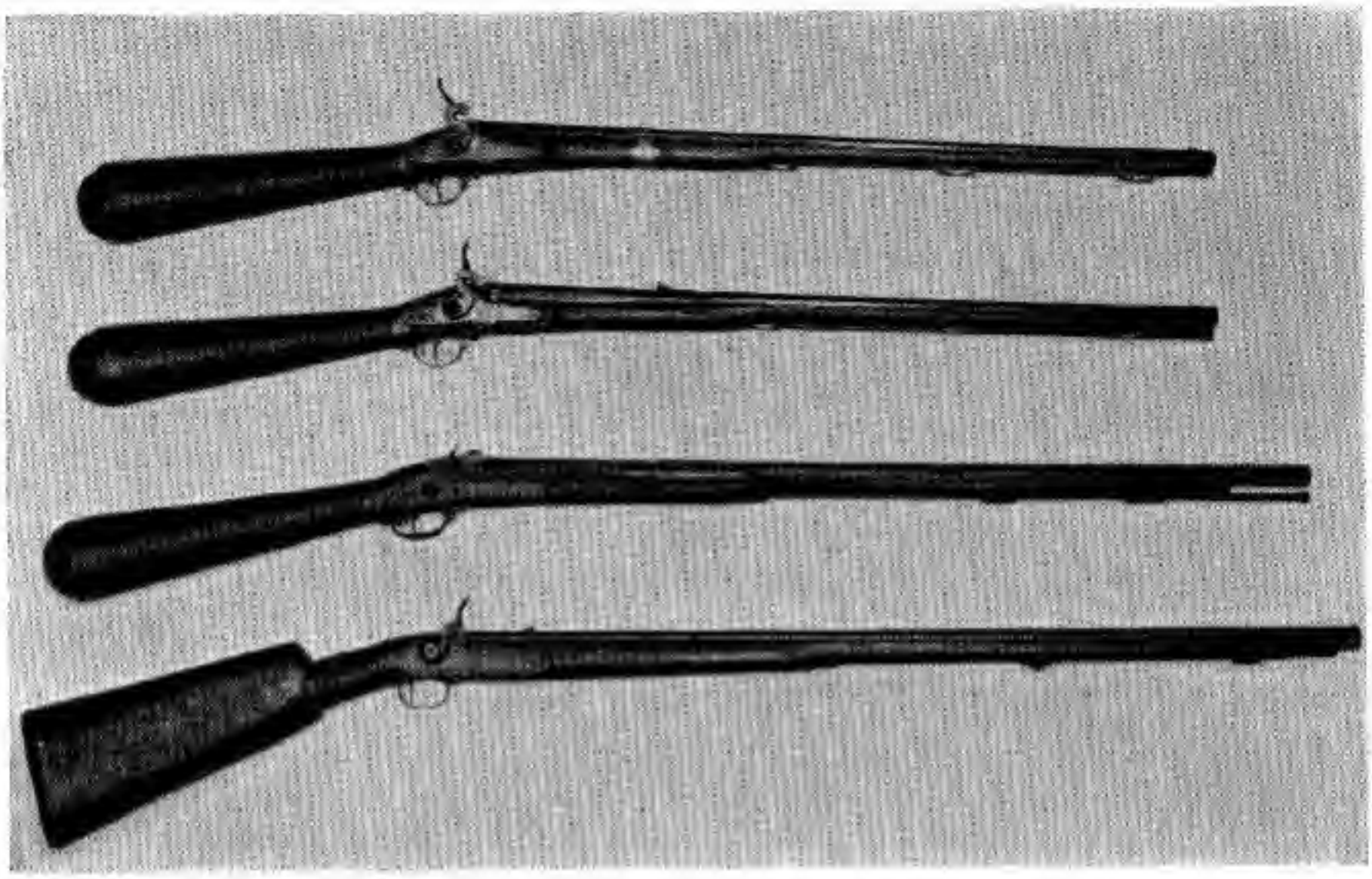

Fig. 50. Austrian Butt-reservoir Air Guns.
1st. Lowentz shotgun.
2nd. Lowentz rifle with magazine.
3rd. Staudenmayer rifle, London.
4th. Muller rifle, Bern.
(Neg. 203341; 3rd, Nunn. No. N551)

The Austrian type air gun, in its final form, consisted of two units: the butt-reservoir and the union of forestock, barrel, and lock. This is true not only of the long arms but also of pistols, a distinct variety of the latter having been examined. Regardless of makers, the basic pattern was adhered to and, even though there may be minor variants, the type is distinctly recognizable. For this reason, as well as the fact that the products are historically dated, this type is considered the ultimate in continental butt-reservoir air guns.

The series presented includes one example from Switzerland that differs in some respects from the balance of the specimens. It therefore will be separately mentioned when the discussion touches on the differing points.

In the case of the long arms, with the exception of the Swiss piece, which has a shaped butt, the presently considered type is uniformly equipped with conical butts of iron, lap-welded lengthwise, with inset convex end caps instead of butt plates. The reservoirs are additionally riveted, although the external appearance may belie the fact. Internal examination is advisable to verify construction techniques. Indications of brazing appear on all the specimens and it is possible that brass was spotted where needed to close up minute holes that were left after the welding and riveting. The end caps give no indications of being riveted, but are inset and have the ends of the cones peened over and welded. Judging by the rough exterior surfaces on the reservoirs and also the fact that

several Austrian butts are covered with leather, it is believed that all were originally so covered. Incidentally, the Swiss example still is.

Two of the reservoirs have touch marks which appear to be government proofs. The marks consist of the typical Austrian double-headed spread eagle. Two other reservoirs are marked "20 L;" and one, "18 L."

The butt-reservoirs on the pistols are different in shape and construction. They were made in halves and held with a welt weld, i.e., the halves are butt-welded and then a welt strip is applied to the seam. The welt is additionally pinned with small rivets and the entire receptacle has been spot brazed to seal any possible leaks. In these cases also, inasmuch as one specimen is so covered, it is believed that a leather sheathing was normal.

Valves are made of several layers of leather on steel stems, shaped slightly conical and having a remarkably short bearing surface on the valve seats. They resemble the shorter valves of the outside-locks, but are made with greater care. Valve seats are brass in all the cases investigated.

The principle of discharge is quite consistent in the series, although the specific design or proportion of units may vary. A stud, usually on the tumbler, engages the notch in a striking pin. The latter is driven backward, toward the butt, and in turn drives the valve backward into an open position. The stud then slips out of the notch and the striker (or striking pin) returns to its forward position, allowing the valve to close. The striker is so constructed that the stud of the tumbler, while the hammer is being cocked, passes over the striker, temporarily pushing a hinged member out of line and then, when passed, permits the member to return into engagement position. Normal lowering of the hammer will thus open the valve in every case unless a by-pass is provided. This, when present, consists of a stud that, when depressed, pushes the hinged member of the striker out of line, permitting the hammer to be lowered without forcing the striker back. The stud is either a pin that protrudes upward on the left upper surface of the receiver, or else a sliding button on the left plate.

The usual hammer is in an S-form and is provided with an exaggerated cocking ear. It will be noted that the example by Staudenmayer had a distinctly different hammer form. Actually, the hammer is nothing more than a cocking lever. Time proved the uselessness of the member and ultimately British makers did away with it entirely, substituting a removable key.

Four methods of loading have been encountered in the Austrian butt-reservoir air guns. The oldest variety has a removable barrel which may be loaded from the breech after being unscrewed from the receiver. No ramrod is present. This is a form that appears to have been a recognized one but which preceded the fully developed variety. This latter type may be loaded: (1) via the muzzle with a ramrod, (2) like a bellows gun with a flip-up breech, or (3) by means of the Girardoni breech. The latter consists of a transverse block, perforated with a bullet cavity in line with the air tube and the barrel, which carries a ball from a tubular magazine alongside the barrel to shooting position.

Because of the quality of rifling found in the Austrian air guns, we are persuaded that the smooth bores were designed as shotguns.

In a section to follow it will be noted that the Girardoni type breech is also found on a ball-reservoir gun and, rotated vertically, on a pair of unidentified pistols, in the Metropolitan Museum of Art, labeled "Italian." This is an example of the transition of an air gun essential to an arm of radically different type. Advantage was apparently taken of improvements that were adopted in part when deemed desirable enough. The vertically disposed bar actually anticipated the elevator later employed in Winchester, Vetterli, and other rifles.

The Austrian butt-reservoir air guns are the ones previously referred to as the military type, model 1780. No unquestioned examples of the true military variety have come to light. Rumor has it that the existing supply of such pieces, having fallen into disrepair without anyone knowing how to restore them to usefulness, was sold for junk! This is supposed to have occurred about the middle of the last century. The specimens that have been observed are believed to be sporting examples of the same mechanism.

The following names have been found on Austrian butt-reservoir air guns, or have been associated with them in references.

CANTRINER (CONTRINER) VIENNA, AUSTRIA

A number of examples are attributed to this maker. Aside from the specimens examined (Fig. 49), the following have been found in the references at our disposal.

"Air-gun, with receptacle for air placed in the butt-end, made by Contriner of Vienna" (58, p. 558).

Dexter (61) listed a pistol crosshow by Jos. Contriner, Vienna. In another list the same dealer (60) states, "AIR PISTOL. This is a very highly ornamented creation with 'IN WIEN' inlaid in the lock-plate in gold and 'CONTRINER' inlaid in the barrel in gold. It is repeating and mighty well made—also extremely ornamental. Full stock. 7½" octagonal bb." In another list (59) there was included a second Contriner repeating air pistol.

Stockel (224) lists: "CONTRINER . . . i. Wien?, ca. 1850. CONTRINER, Joseph, i. Wien, ca. 1810-ca. 1850."

Gardner (87) lists: "Contriner—Gunsmith of Vienna—1750. Contriner, Carl—Gunsmith of Vienna—1860. Contriner, Johann—Son of Carl. Gunsmith of Vienna, 1870. Contriner, Joseph—Gunsmith of Vienna."

COLNOT VIENNA, AUSTRIA

". . . Austrian air gun, barrel and lockplate signed in gold *Colnot in Wien;* steel air chamber at butt" (179, No. 292).

Locke (160) noted a pistol, system Girardoni, by Colnot.

CREWFE HERZBERG, GERMANY

Bannerman's catalog (12) states: "8609.—ANCIENT AIR PISTOL. By Crewfe in Herzberg, sharkskin covered butt air chamber, shot magazine in tube on the side, cocking the hammer opens the air chamber, bullet feeds into the barrel in the magazine by gravity, through the breech carrier; engraved frame, side safety, folding leaf rear sight, silver front sight, walnut stock, engraved mountings, 10½ inch barrel rifled at the muzzle, rare weapon, prohibited in olden times." The piece is sufficiently described for one to recognize the Girardoni breech and side by-pass, although the words must be interpreted in the light of present knowledge.

Gardner (87) lists: Crewfe—Gunsmith of Herzberg, 1810.

FRUWIRTH VIENNA, AUSTRIA

This name occurs on the pistol in Fig. 48.

Stockel (224) lists: FRUWIRTH (Fruehwirths, Fruewerth, Fruewürth, Fruhwirth), Joseph, in Vienna, c. 1740–c. 1790. This maker used a stamp numbered 409 in about 1740, and number 410 in about 1750.

GIRARDONI (GIRANDONI, GIRARDONY) VIENNA, AUSTRIA

This is the inventor of the famous Girardoni breech loading system. Regarding this, Thierbach (228, p. 447) says: "One other fashion of transporting the charge out of the magazine to the barrel was by means of a transverse bar or carrier which is fastened behind the magazine tube, which in turn is along-side the barrel, the charges being taken from the same and, by a transverse push, being carried over to the barrel. These devices were taken up in the construction of air guns in which case they were applied to carry over the bullets to the barrel. It was remarkably simple and assured the greatest safety against the ignition of the magazine inasmuch as the flame had to strike between the barrel and the bar before it could arrive at the powder magazine. One such device is found in the Hall of Models in the Imperial Arsenal of Vienna, wherein is found a gun with the mark, 'Girandoni II 1780.'" (It is a matter of question whether this report of the spelling of the name is correct.)

The same writer, however, says later (228, appendix, p. 24): "The dangerous character of this mechanism was exemplified in simple fashion by the fact that Girandoni himself lost his left hand in an explosion of the magazine which was the occasion for the cancellation of an order of 1000 arms of this type. Girandoni thereupon applied this mechanism to air guns in which the air container was in the butt. With such guns in January of 1788 in Austria 4 men (every fourth man? *je 4 Mann*) of every company were armed; whereupon in 1790 a particular division of 1300 men was developed out of this original number, which, however, was disbanded in January, 1815, because as a claimed reason, the fact that the guns required too many repairs (Dolleczek)."

The Girardoni breech is found not only on air guns bearing that name,

but also on a number of others, the following having been examined: Fruwirth, Oesterleins, Staudenmayer, Contriner, and Lowentz. The "I. Bang Hoang" (11) and a piece by Zimmer (34) are also so equipped. It is questionable whether Girardoni ever made any guns. He probably permitted others to use the device. Examination indicates that the pistol marked "Girardoni" (Fig. 48) was probably made by Contriner.

HEIBERGER, C. VIENNA, AUSTRIA

This maker produced the early variety of Austrian butt-reservoir air gun, an example of which is in the Mack Collection (162). Barrel, receiver, and butt separate as in the case of a Nunnemacher piece shown in Fig. 49. Stockel (224) lists this maker as a Viennese, c. 1750. The piece in the Mack Collection is one of the items which has been listed as a poacher's arm (253, p. 25).

HOHLI, J. BERNE, SWITZERLAND

An over-under double-barrelled air gun by this maker is reported (123). The upper barrel is rifled, the lower is smooth. Our correspondent suggests a date of 1779–1835 for this maker.

I. BANG HOANG

Bannerman's Catalog (11) says: "2434. Ancient Magazine Air Rifle, with outside dummy hammer, as air guns were prohibited in olden times by rulers in Oriental countries, who feared the silent bullet. Lock is engraved '1814, I. Bang Hoang.' Metal air cylinder in stock, with sliding gate, with chamber for conveying bullet from magazine to barrel; air chamber can be filled by bicycle pump. Rifle is 43 inches full length, and shoots about 45 calibre bullets. Rare weapon. Price, $38.00." This is the well-known quotation about "Oriental air guns." The specimen is an Austrian butt-reservoir air gun with a Girardoni type breech. It bears a Russian inscription that has been translated, "Ivan in Polin."

LOWENZ, JOSEPH VIENNA, AUSTRIA

Stockel (224) lists this maker (also spelled Lowentz) as an air gun maker of Vienna, c. 1750–c. 1800. He notes also three examples of Lowenz known to him. Two specimens have been examined, both long arms, one a normal muzzle loader, the other equipped with a Girardoni breech. The former is a shotgun, the latter a rifle (Fig. 50).

MÜLLER, J. BERNE, SWITZERLAND

Stockel (224) lists this maker and dates him 1840 (Fig. 50).

OESTERLEINS, JOS. VIENNA, AUSTRIA

Listing this maker, Stockel (224) dates him at c. 1815. He indicates that three examples were known at the time of listing. Up to the present only

pistols by Oesterleins have been encountered (Fig. 48). As far as is known, the Girardoni type breech was always applied.

PIRKO, CARL VIENNA, AUSTRIA

Stockel (224) indicates a knowledge of nine examples by this maker, dating him c. 1850–c. 1867. The specimen that has been available for examination has a tip-up breech similar to the Wolf, which follows later. The Pirko specimen was the property of Prof. L. D. Rowell (206), Madison, Wis. Stockel (224) also lists Mulacz as working with Pirko, making breech loaders. It is not known whether Mulacz ever marked pieces, aside from bellows guns, with his own name, hence he is not separately listed here. Neither is it definitely known whether the products Stockel refers to were air guns. They may have been of the bellows type.

SCHEMBOR, JOS. VIENNA, AUSTRIA

Two references to the example originally in the Charles Noe Daly Collection are at hand (179, No. 347; 240). They concern a breech-loader similar to the Wolf, and the Pirko, which see. Stockel (224) dates Schembor c. 1790–c. 1820.

STAUDENMAYER LONDON, ENGLAND

It appears that Staudenmayer, who came to London somewhere around 1805 and introduced there the Austrian variety of air rifle, was a German, not an Austrian (57), although the opinion may be questioned. It is also claimed that he introduced the cylindro-conoidal ball and the belted ball. An example of Staudenmayer's air rifle of the Austrian variety is shown in Fig. 50. It is fitted with a Girardoni magazine. An improvement on this arm, fitted with a tubular magazine below the barrel, whence the bullets passed into a faucet breech, is known (18). He is also credited with an Austrian type air pistol (217) and an air cane (10). Additional references to this maker are noted in the chapter dealing with British pneumatics (Page 111).

STIRDA VIENNA, AUSTRIA

Serven (214) lists and illustrates an example of "primitive" Austrian air gun by this maker. It is similar to the Nunnemacher specimen shown in Fig. 49.

WOLF, A.

One example by this maker was examined (Fig. 49), in which the breech tips up as in the case of the bellows guns. The butt that originally was with this specimen was tested for possible rupture and had a seam open under a pressure of 3000–3500 pounds per square inch. The present butt is a replacement.

ZIMMER, PHILLIPP MAINZ, GERMANY

Stockel (224) lists this maker and dates him c. 1820. One example has come to our attention, it being in the Major R. Brown Collection (34), London. It is equipped with a Girardoni type breech.

Barrel-Surrounding-Reservoir Air Guns, German and English

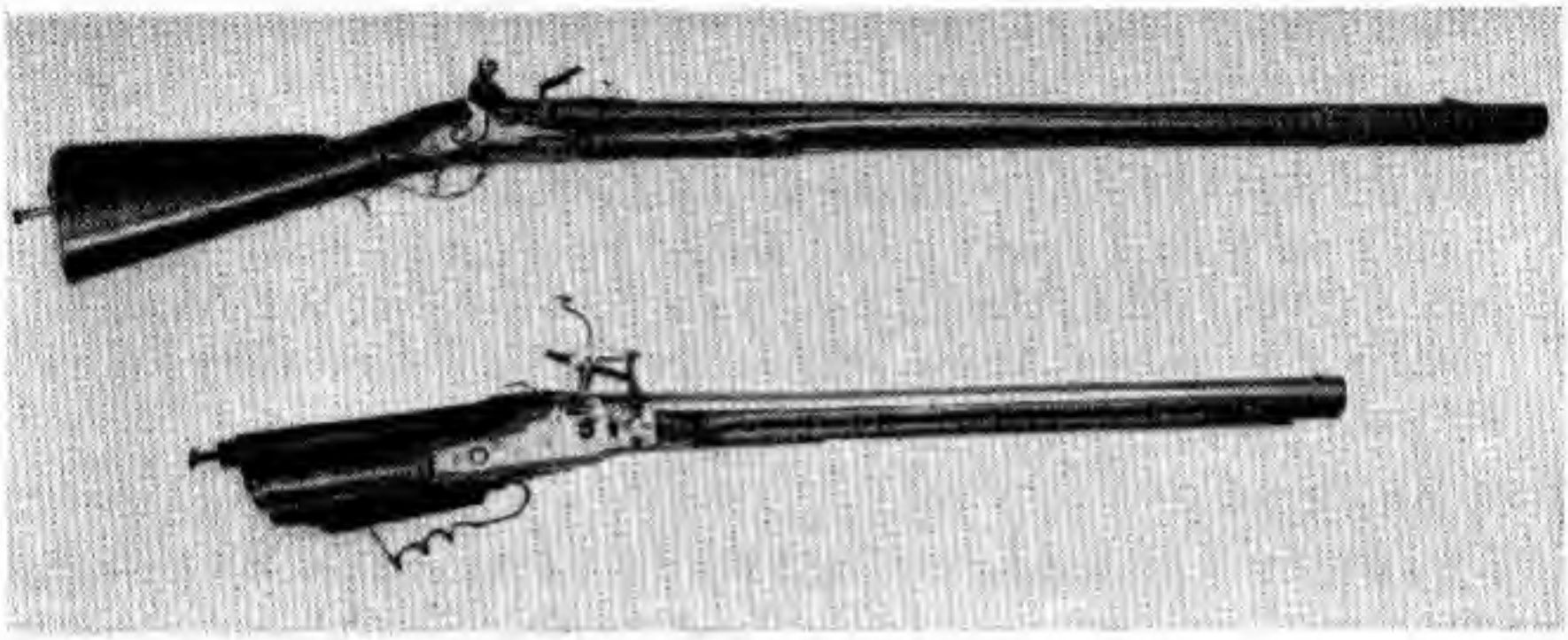

Fig. 51. Barrel-surrounding-reservoir Guns.
Upper: Saps.
Lower: Wheel lock, maker unknown.
(Neg. 203353)

The barrel-surrounding-reservoir air gun is one that is deceptive at first glance. The impression normally conveyed is that of a heavy-barrelled piece, but a closer inspection reveals that the bore is remarkably small, and thereafter the relative lightness also becomes apparent. Several additional features are characteristic. In this type of arm there is a pump in the butt. Two valves are also present as in the case of the transitional butt-reservoir variety. Normally, in other air guns, the same valve serves as intake and exit seal. With the peculiar structure of the barrel-surrounding-reservoir air gun it is necessary to have a valve at the head of the pump and one at the breech of the bore. The problem of maintenance is no doubt intensified accordingly.

The lock operates, by means of a lever, in an upward direction, opening the internal exit valve. This, it will be observed later (Page 102), is the same mechanism that was applied to the ball-over-barrel air gun. In the latter case an entirely different appearance was created, but the lock principle was identical.

It is not presently known how many continental makers produced barrel-reservoir air guns. Two makers have definitely come to light, although another, whose products are known as English, may have made the same thing while in Germany. Examples are quite rare and it appears reasonable to presume that makers also were very few.

According to Arne Hoff (121), "the Tøjhusmuseum of Copenhagen, Denmark, has a set consisting of two air-guns and a pair of air-pistols of this system from the middle of the XVII century. The two guns are signed on the barrel, one 'GEORGE FEHR 1653' and the other 'GEORGE FEHR DRESDEN 1655.'

The pistols have no signature or date, but are in construction and whole appearance closely connected with the guns."

The discharge mechanism consists of an under hammer which opens a valve in its upward passage, the perfect reverse of the bar-lock, which is to be discussed later (Page 105).

Hoff (121) continues, "The maker of these air-guns, George Fehr, was a regimental gunsmith in the service of the Elector of Saxony. In 1652 he was accepted as a member of the corporation of Gunmakers in Dresden on special conditions after recommendation by the Elector. Besides the air-guns here mentioned his name is found on a wheelock rifle, dated 1659, in the Gewehrgallerie, Dresden."

The Berlin Gunsmith, Sars, is listed in a number of references without much data. There is confusion regarding this name, however, as the one specimen examined is clearly marked, "I.C.SAPS." The initials listed for the spelling "Sars" are the following; T.C., J.A., and F.C.

Demmin (58) refers to Sars as one of the early German armorers who developed the air gun. Gardner (87) lists J. A. Sars as an arquebusier of Berlin, 1760. Demmin (58) credits a ball-reservoir air gun to T. C. Sars. Maretsch (165) claims that two Berlin gunsmiths in the eighteenth century, G. Gerlach and T. C. Sars, busied themselves particularly in the development of air guns. We know little of the products of Gerlach, however. Feldhaus (79) identifies one specimen, 18th century, caliber 8.2 mm., but fails to give a description. Stockel (224), who notes three examples of that maker's work, identifies J. C. Saps (in the German lettering the same as I. C. Saps) as an air gun maker of Berlin, c. 1730 to c. 1760.

We know nothing regarding the possible maker of the wheel lock barrel-reservoir gun that has come to our attention. The piece is unique in its operation, inasmuch as it does not act in any way like a wheel lock—indeed, more like a back-acting flint-lock, which leads one to wonder at the date of the specimen. After the reservoir is charged with air and the barrel loaded with a ball, a button on the side of the lock is pushed in, thus setting the sear. The cock is then drawn backward toward the "pan." The button mechanism suspends the cock about an inch above the top edge of the lock plate. The trigger is then set and, when pulled, relases the cock, which snaps downward on the pan. An internal lever meanwhile opens the valve in a manner similar to other weapons of this basic form. If one forgets to push the button the lock is not set and the cock will not stay suspended, except in forward position, where it accomplishes nothing.

Aside from the unique mechanism of this weapon, attention is definitely called to the combination of octagonal barrel and curly wood stock. Both are components of later Kentucky rifles and may here be seen as one of the possible predecessors of that famous American weapon, as suggested in the recently published Kentucky Rifle Credo (104, p. 617). Other elements, particularly concerned with external form, are similarly referred to in the above discussion.

The barrel-surrounding-reservoir air gun is further known by an example attributed to Kolbe of London (104, p. 337) who is also listed as a maker in Suhl, Germany (87; 104, p. 338). While the British product is not available for examination, the description leads us to believe that it is mechanically identical with the Saps piece. An illustration from the 1796 edition of the Encyclopedia Londinensis (71) clearly indicates the mechanism of another English air gun of the same type. It had, in addition, a bullet magazine below the barrel, which makes the gun a repeater. This is stated as "an improvement of the common air gun, made by the ingeneous artist L. Colbe." There is little question but that Kolbe and Colbe are the same name, probably father and son, in one instance the spelling being German, in the other English. The Kolbe of Suhl (104, p. 338) was Johann Gottfried, an engraver and chiseler until at least 1747, who presumably made the London example that is so similar to that of Saps. L. Colbe, who made the same type gun with improvements a half century later, is probably the son.

Ball-Reservoir Air Guns — Continental

BALL OVER THE BARREL

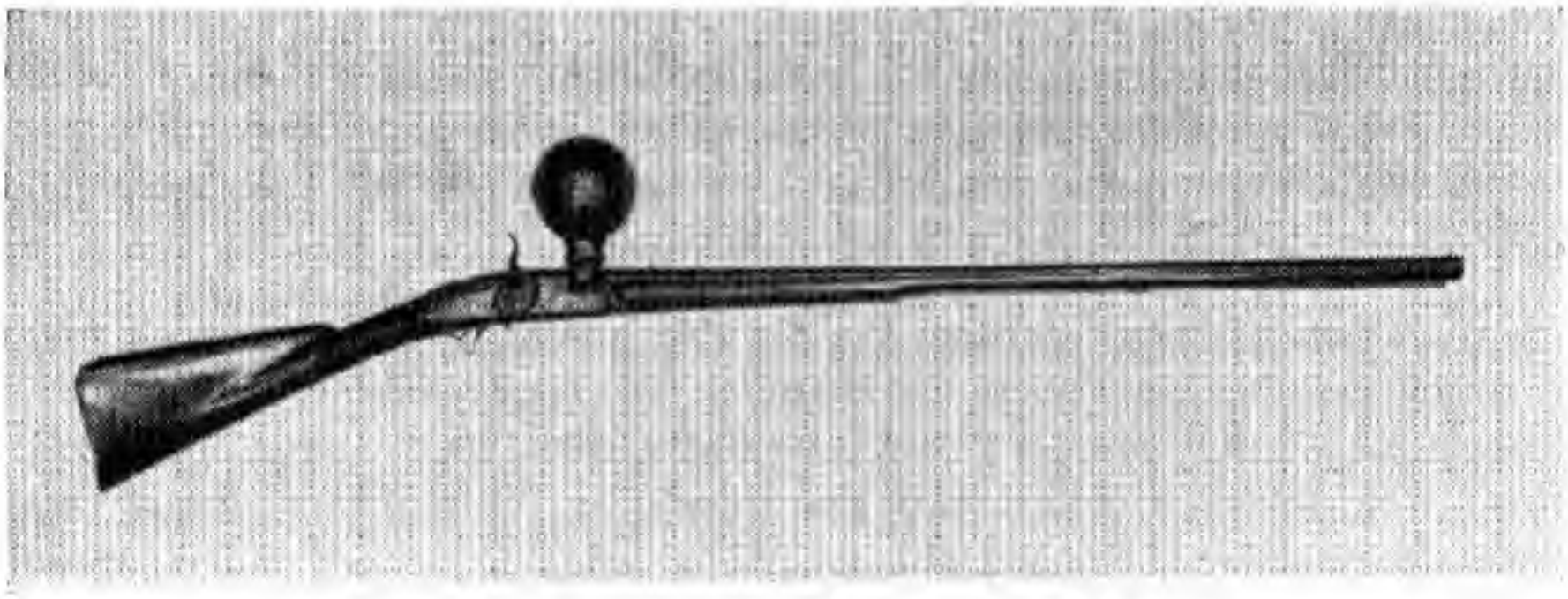

Fig. 52. Ball-over-barrel Air Gun. Bate, London.
(Neg. 203279; Nunn. No. N549)

There is little that can be said of this variety. It is recognizable at a glance. It is a normal ball-reservoir air gun that has the ball-reservoir screwed to a special fitting at the breech, the sights being set to one side to compensate for the obstruction. The form appears to be German in origin. In the splendid arms collection of Major Wm. Renwick (201) there is to be seen an example of the ball-over-barrel air gun made by V. D. Fecht, Berlin, and so marked. A plug, which is screwed in place of the ball when the latter is removed, simulated a frizzen, thus completing the impression of a flint-lock. Plugs are not uncommon, and are intended to keep air ports clean. The reservoir for the Fecht piece is, unfortunately, missing.

Stockel (224) lists a family of several generations by the name of Fecht, beginning with George, a locksmith, 1675–1740, and ending with Christian Ludvig II, who died in 1827.

This is another of the air gun types that migrated to England where Thomas Bate produced the same thing. Demmin (58) illustrates a similar item, identified as the work of Gerlach. He claims that it was made in the Arsenal of Berlin, and that another similar specimen is in the Museum of Artillery, Paris.

This form, as was noted previously, employed the identical release used in the barrel-reservoir gun. The advantage in the ball type, if any, was the fact that the weapon needed only one valve. The proportions were different and the entire arm slimmer. With a removable reservoir it was necessary to have an auxiliary pump instead of having one built in. The advantage of having the reservoir placed vertically at the breech is in question.

Having no continental example available for illustration, the London Bate specimen is here employed. The logical development to the bottom-ball will be taken up below.

BERLIN BOTTOM-BALL

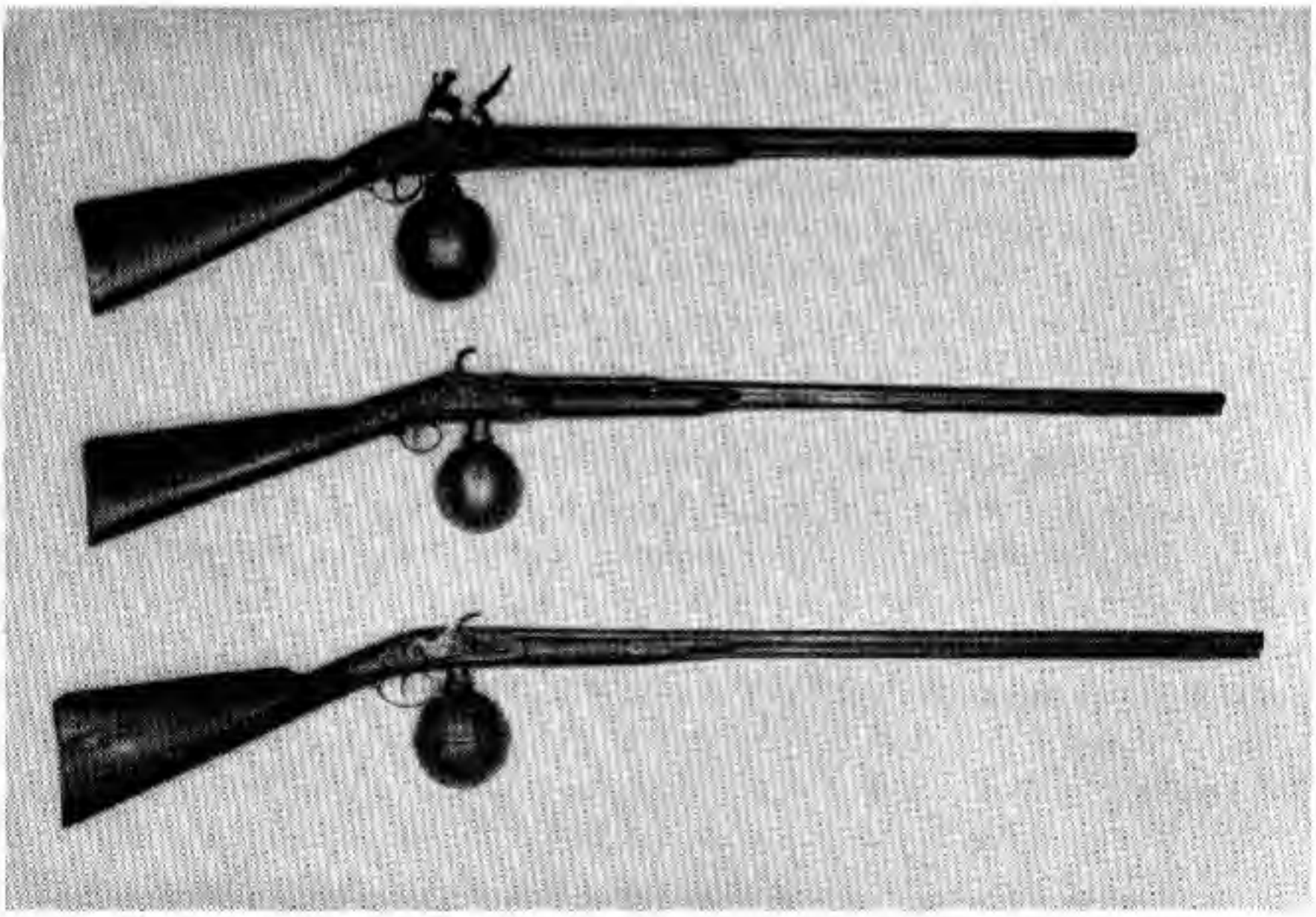

Fig. 53. Berlin Bottom-ball Air Guns.
Upper: Potsdam magazine.
Middle: Kelk.
Lower: Unmarked.
(Neg. 203280; upper, Nunn. No. N10809; middle, No. N10859; lower, Nunn. No. N5888)

The bottom-ball air gun, in which the reservoir is so close to the trigger guard as to almost touch it, is the development of a small alteration of the release that has been considered previously. (We are referring to the continental, not the later English variety.) In the top-ball and barrel-reservoir guns the power of the hammer was taken off the downward-moving front ear of the tumbler. This movement was transmitted by means of a pivoted lever, and thus the thrust, at the front end of the lever, was upward. In the bottom-ball guns this mechanism was altered by cutting off the front arm of the lever and allowing the remaining portion to thrust downward and thus open the valve of the reservoir which, obviously, had to be very close to the trigger. A side-acting by-pass allowed the tumbler to slip above the lever for repeated shooting.

Three examples of continental air guns of this description have been studied. One is from the Potsdam Magazine and is so marked. Another is marked "Kelk," but not identified as to origin. The third is unmarked.

The Potsdam piece is a seven-shot arm, seven small-bore tubes having been soldered together into one pepperbox unit, all barrels being connected and capable of a unit discharge. It has been called a seven-barreled goose gun, and probably was originally intended for such use.

Although the Kelk gun belies the fact in general external appearance, its lock is mechanically identical with that of the Potsdam specimen. The hammer of the Kelk is of the box-lock variety in assembly but has an ear similar to the bar-lock, which will be considered later (Page 105). One interesting feature of this ball-reservoir gun is the Girardoni type magazine alongside the barrel and the transverse block which is a feature of the Girardoni breech. The block, however, differing from those on the Austrian type of air gun, is not provided with a return spring. Re-alining must be done manually. The Kelk is the only arm of the ball-reservoir type presently known that has the breech and magazine that has otherwise been associated only with butt-reservoir air guns.

An interesting feature of the unmarked example is the outside main spring, which has been noted as also occurring on a British air gun by Staudenmayer (103). The hammer ear is also similar to that on the butt-reservoir piece by that maker.

WALKING-BEAM-LEVER BALL-RESERVOIR

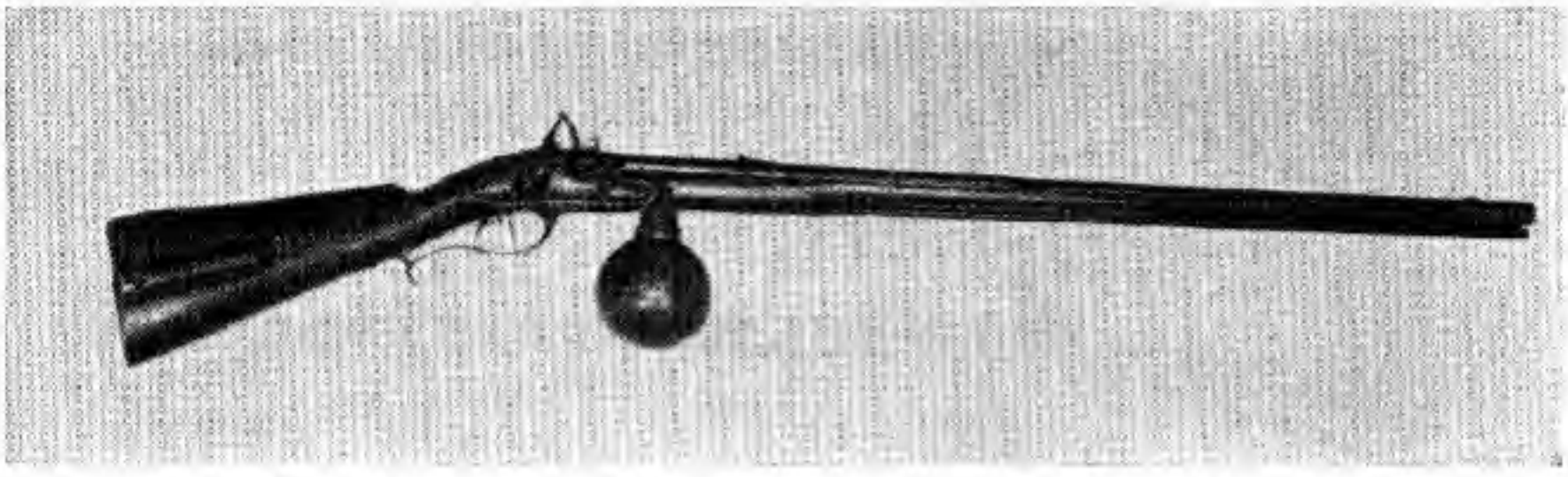

Fig. 54. Walking-beam-lever Ball-reservoir Air Gun. Unmarked. (Neg. 203281)

There was produced at an unknown date, presumably not long after the development of the ball-over-barrel and the barrel-surrounding-reservoir air guns, a curious divergent mechanism. In the two forms just referred to, the power that releases the valve is taken off the front of the tumbler. In the case of the divergent type, the power is taken from the rear of the tumbler and a walking-beam mechanism transmits that power forward to the valve. Only one example of this form has been available for examination, the only one presently known to exist. That the type is rare is not questioned.

Differing from the Berlin bottom-ball type, the reservoir in this case is a fair distance ahead of the trigger, the place of attachment being about one ball's diameter ahead. Casual examination might cause one to suspect that this is the same as the double-link-release type which will be considered later (Page 109). Detailed inspection shows, however, that there is a standing pivot stud on the barrel above the lock upon which the walking-beam operates.

No data are presently available that might suggest distribution.

BAR-LOCK AIR GUNS

This form of release is so similar to the mule-ear percussion lock that there has been some speculation as to whether it may have actually served as the basic inspiration for that short-lived mechanism. The bar-lock is a direct-striking device which, without any intermediate member, releases the requisite amount of air from the reservoir and then, by slipping past the valve stud, permits the valve to close. This is accomplished by the extension of the arc of descent, which in its extreme is beyond the stud. The other multiple-pressure air guns are equipped with some form of linkage that accomplishes the desired action indirectly. This may be an inversion of a type in which the striking is directed from the bottom and the ball therefore placed on top, or of the variety discussed by Hoff (121).

The actual striker on the hammer may be a movable member that can be

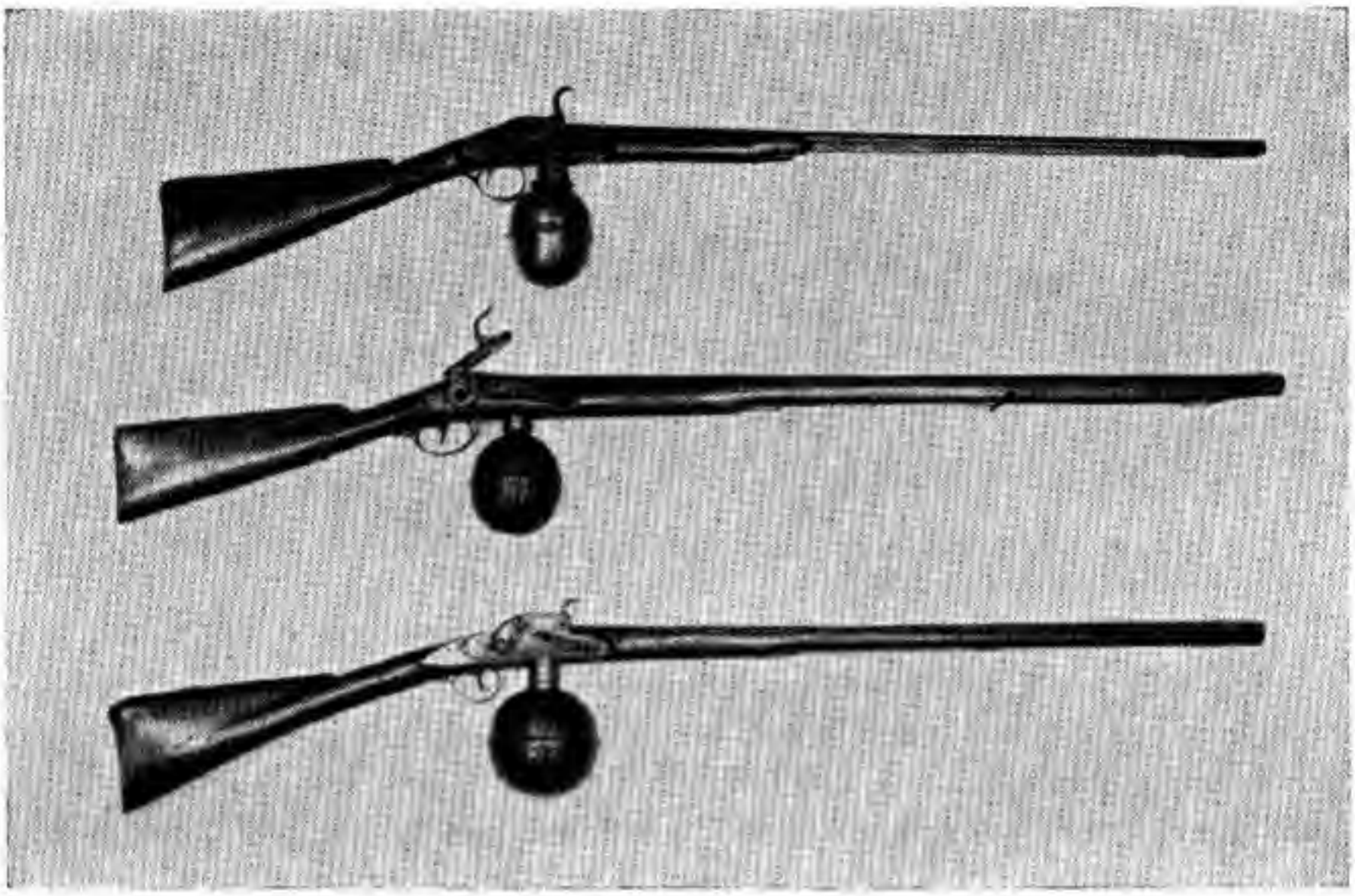

Fig. 55. Bar-lock Air Guns.
Upper: Centrally hung reservoir, Houghton.
Middle: Centrally hung reservoir, unmarked.
Lower: Side hung reservoir, unmarked.
(Neg. 203282; upper, Nunn. No. N6323; middle, Nunn. No. N550)

placed in an optional position to either strike for discharge or in a manner reminiscent of certain outside-lock forms, be swung or pushed out of alinement, thus serving as a safety. Two forms are known, both of which can be recognized at a glance. In one case the ball is located centrally below the stock, ahead of the trigger; in the other instance the ball is placed to the right, just below the lock plate. The valve stud in the former protrudes through the barrel, and in the latter through an opening in the lock plate itself.

According to Demmin (58, p. 558) one such bar-lock air gun, by T. C. Sars, Berlin, is located in the Museum of Artillery in Paris, where it is numbered 1348. The illustration in Demmin is poor but the mechanism is not in doubt. In this case the centrally-hung ball with a barrel-perforating pin is evident. The name of Sars (or Saps) is, as has been mentioned previously (Page 101), a confusing matter, but the form of gun shown in Demmin suggests age. We are, therefore, of the opinion that the bar-lock is one of the older varieties of air gun. It appears to be a closed series, having no developmental antecedents nor successors. The only connection between this form and other air guns is in the use of the ball-reservoir.

An example by I. G. Fischer of Oederan, Saxony, has been reported (217) and, while the description is not too detailed, appears to be of the centrally-hung variety.

In the U. S. Cartridge Company's Catalog (231, p. 103) there is shown an

air gun of this variety that is marked C. G. Werner, 1752. Werner is reported to have been a gunmaker in Leipsic, 1750–1780. The illustration clearly shows the swinging striker which, in this case, is in safe position.

Only three examples have been available for examination. Two are of the centrally-hung ball type, completing the series of presently known examples. One, in the Nunnemacher Collection (N550), is unmarked; the other, also a Nunnemacher piece (N6323), is marked "Houghton" and has a barrel that is marked with what appear to be the remaining evidences of English proof marks.

Of the two basic types of bar-lock air guns, the side-hung variety appears to be the rarer. One example was examined and one other was identified by illustration.

The former has been examined by Dr. B. F. Kukachka (146) of the Forest Products Laboratories, Madison, Wisconsin, in hope of having the wood of the stock identified. Dr. Kukachka assured us, after a careful examination, that the stock was made of European walnut, which cannot be assigned to any country. All "native" European walnuts are of the same species, he said, and therefore, regardless of the specific place of origin, the structure of the wood is identical. It is definitely not American walnut. This places the specimen in question in Europe but does not tell whether the gun was stocked with continental or English wood. The details of the stock, however, suggest England, including the form of the butt, the pinning of the forestock, and the general lines. Without marks, however, the assignment can be made tentatively only, and on somewhat slim evidence.

The only other example of the side-hung ball bar-lock is available through a photograph, but explains the reason for the detailed examination of the previously mentioned specimen. This gun has all the lines of a Kentucky rifle, beginning with the characteristic butt, following up the wrist with the expected trigger guard, to the properly shaped forestock, ramrod thimbles, and finally, the fore end cap. The wood has a wavy grain and may be curly maple. This appears to be truly a Kentucky air gun. Its present location is unknown. Whether the essentials of the mechanism are American or whether they were imported is not known.

In view of the previously noted opinions regarding the origin of the Kentucky rifle (Page 101), this specimen might indeed be of European origin and might, in addition, be another arms link between the Old World and the New.

British Pneumatics

Aside from cane guns, which comprise a separate chapter (Page 115), the story of British air guns is one of immigration and subsequent adaptation. It is questionable whether any true air gun invention can be credited to any British maker. As opposed to this harsh remark is the fact that the skill and ingenuity of the English artisans produced developments that were the equal, and in many instances the superior of anything theretofore made. This is the natural result of the adaptation of the air gun by a nation that was noted for fine firearms.

Precisely when the first air gun came to England is a matter of question. The earliest encountered reference is the one of the "wind-gun" that was so hopefully bought with the intent of assassinating Cromwell, but it is doubtful whether the arm ever arrived in England at all.

It appears that the first positive knowledge and production of air guns in England are illustrated by the ball-over-barrel type, such as made by Bate, the barrel-surrounding one by Kolbe (both of these having an identical lock mechanism), and the butt-reservoir one by Staudenmayer.

The variety that had the ball over the barrel has already been discussed in a previous chapter (Page 102), where the Bate specimen has been illustrated (Fig. 52).

The barrel-surrounding-reservoir form by Kolbe (also spelled Colbe) has been referred to as an improvement of the common air gun (71). The improvement appears to be the application of a tubular bullet magazine below the barrel and reservoir assembly, which fed the projectiles to the breech via a faucet device that was externally the frizzen of a flint-lock. The reference indicates such rapidity of discharge ". . . as to be nearly of the same use as so many different guns; the only motion required, after the air has been injected, being that of shutting and opening the hammer, and cocking and pulling the trigger." The term "hammer" here refers to the frizzen, and is the old name for that member. The device is known to us only through a drawing, no examples having survived to our knowledge.

It appears that the air gun with the reservoir around the barrel was short-lived in England. By the addition of another lever in the discharge mechanism, similar to the previous one, it was possible to place the ball-reservoir, which at least Bate had used above the barrel, below the latter and thus, by the alteration of the lock, improve the appearance of the gun and establish the ball-reservoir air gun as an accepted type (Figs. 56, 57). With the use of but one valve, that an integral part of a removable ball, the barrel-surrounding-reservoir gun was dropped, as it needed two valves. Possibly, too, the apparently traditional desire in England for slim beauty in guns contributed to the abandonment of the barrel-surrounding-reservoir type, which is admittedly very heavy in appearance.

One feature, however, of the Kolbe gun was retained, that being the faucet

breech. In another form this basic mechanism reappeared later. The question arises, in this connection, whether this breech device was responsible at least in part, for the "Cookson type" repeater that appeared at about the same time. If this is the case, score another point in favor of air gun makers as showing the way to firearms manufacturers. While of questionable value in a repeating firearm, such a faucet breech is excellent in an air gun.

The type that, because of that maker's prominence in the field, we have called the Bate bottom-ball air gun (Fig. 57) was made by a number of other artisans also. It may be recognized as different from the Berlin bottom-ball form by having the reservoir at least one ball's diameter ahead of the trigger. This increased distance was needed to accommodate the additional pivoted lever which directed the thrust downward. A number of makers are noted as having their names on such guns, but whether they were actual producers or merely jobbers is not known. The following names have been found on existing examples.

BATE LONDON

This maker is mentioned in a number of references. Demmin (58) includes him among the armorers who developed the air gun. Gardner (87) says, "Bate, Thomas Gunsmith of London and Birmingham, 1812." According

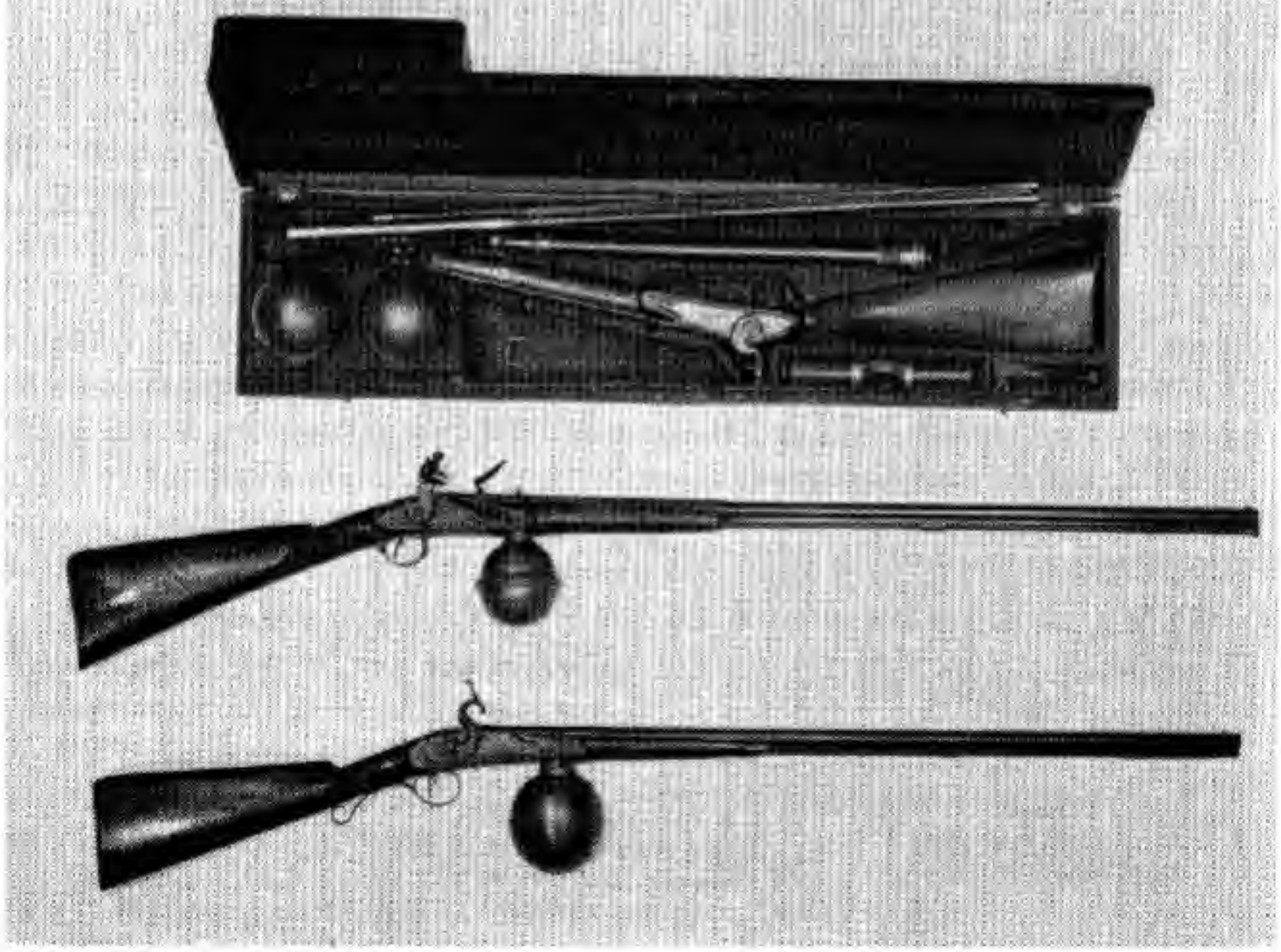

Fig. 56. British Bottom-ball Air Guns.
Upper: Egg (cased set).
Middle: Unmarked.
Lower: Wilkinson.
(Neg. 203358; upper, Nunn. No. N10471)

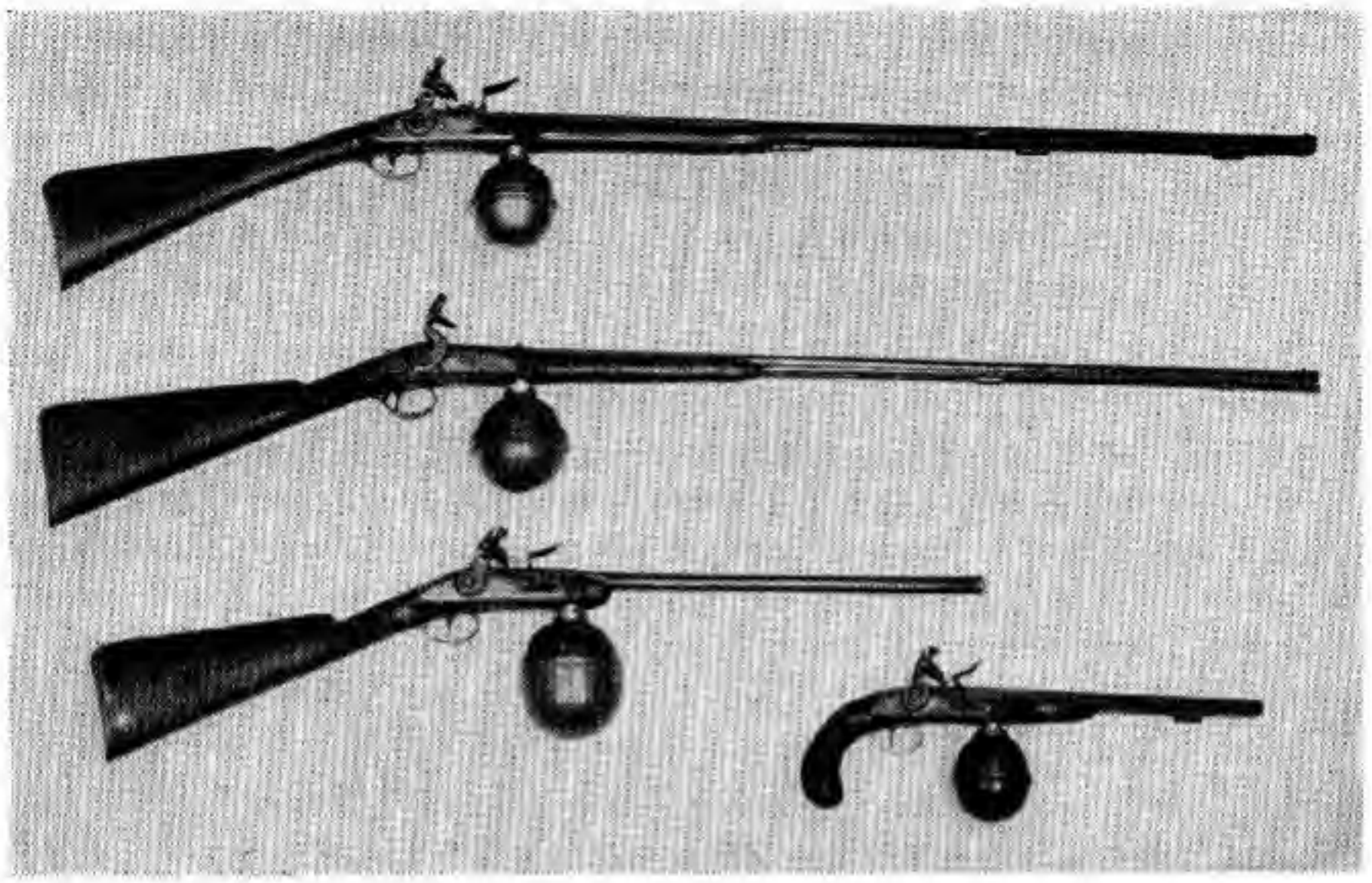

Fig. 57. Bate Bottom-ball Air Guns.
1st. Flint-lock, Bate.
2nd. Half-flint, Jover Son & Bate.
3rd. Flint-lock, Bate, London. A longer auxiliary barrel, part of the set, is not shown.
4th. Flint-lock pistol, Bate, London. A removable butt, once present, is missing.
(Neg. 203355)

to George (90, p. 330), Bate was working in London, 1770–1800. The Bate specimen that illustrates the ball-superior variety (Fig. 52) has a silver trigger guard that bears hall marks dating 1777–1778. Inasmuch as the fiscal years were not from January to December, the apparent difference in dating actually can mean as little as the interval of a few days between one examination and the other (100). The butt plate is dated by the same process and was made between 1775 and 1776. Both items were made by Joseph Heriot of London, whose mark was entered with the Goldsmith Company in 1750.

BUNNEY LONDON

Bunney is listed rather early for this type of air gun. Were it not for the existence of Bate's barrel-superior ball-reservoir gun, which we presume to antedate the bottom-positioned ball, Bunney could possibly be accepted as one of the first British air gun makers. Gardner (87) dates him 1720–40. Stockel (224), who has been quite reliable, dates this maker circa 1750, while George (90, p. 331) brings him up to a still later period, 1770–1790.

DAVIDSON, JOSEPH LONDON

Jackson (133) illustrates a pistol by this maker, suggesting that it was Austrian in type. This is another example of presumption that could become accepted fact. The silver fittings of this pistol bear the hall marks of 1796.

It had ". . . also a skeleton stock, which can be attached." Stockel (224) lists Davidson and dates him at 1796. George (90, p. 331) places him between 1790 and 1820.

EGG, DURS LONDON

Gardner (87) lists this maker as 1785–1834; also D. I. Egg, 1832–65, and others (Fig. 56). George (90, p. 331) dates this maker 1750–1820.

JOVER SON & BATE LONDON

This name appears on one specimen which has been examined (Fig. 57). No published reference has been located.

MARTIN, B. LONDON

One reference to this maker has been located (71), the accompanying illustration indicating basic similarity to this type.

UTTING LONDON

The example by this maker anticipated the later cane guns by having a removable rifled liner within the bore. Here again the air gun industry was ahead of that of gun making, as rifled inserts were subsequently provided for breech-loading shotguns. Gardner (87) lists Utting, John, London and Birmingham, 1800–1820; at Borough Street, London, in 1812. Stockel (224) is silent regarding this maker, but George (90, p. 335) places him in London, 1800–1820. Blanch (28, p. VII) includes Utting in his London Directory of 1812.

WILKINSON, P. LONDON

Wesley (245) describes a gun by this maker. His date has not been determined. A specimen has been examined (Fig. 56).

Staudenmayer, who, we believe, introduced the butt-reservoir air gun to England, is not listed as a Continental maker but, because of his Germanic name and the fact that he produced a truly Austrian butt-reservoir air gun in England, is presumed to have been a refugee driven out by Napoleon. The piece ascribed to him (Fig. 50) is marked "Staudenmayer, London." Except for the unusual form of the cocking piece (hammer), it is Austrian, even to a correct Girardoni type breech.

Staudenmayer is also credited with the production of a tubular-magazine air rifle, which had a faucet breech mechanism operated by a thumb latch on the left side of the receiver (18). This breech device appears to be an improvement on Kolbe's. The lock on this piece by Staudenmayer had two main springs, one on either side of the plate.

The "hammers" of the two Staudenmayer rifles just described are quite similar to each other but, curiously enough, radically different from recognized Austrian forms.

George (90, p. 334) lists S. H. Staudenmayer, London, 1810–1820. Blanch (28, p. VII) identifies him as Standenmayer, S. H., 35, Cockspur St.

Subsequent to Staudenmayer and apparently based upon his butt-reservoir form, numerous makers produced similar air guns, but without the Girardoni breech (Fig. 58). Some were muzzle loaders; others employed a faucet breech

Fig. 58. British Air Guns, Later Type.
Upper: Lancaster (cased).
Middle: Unmarked ball-reservoir gun.
Lower: Unmarked butt-reservoir gun.
(Neg. 203356; upper, Nunn, No. N10470)

almost identical with that by Staudenmayer. They, however, were single loaders, not magazine arms. Instead of having the faucet accept bullets from a magazine below the barrel, the new form had an opening on the top of the receiver and the balls were inserted one at a time as needed.

The butt-reservoir also was altered in form from the conical Austrian type to a true shaped butt. Some were built up over tubular reservoirs into the desired form and covered with sharkskin or leather, making unusually attractive weapons.

The release mechanism employed in the English butt-reservoir guns, when rotated 90° and caused to operate downward, was applied to a contemporarily made ball-reservoir gun. In this case the reservoir is just ahead of the trigger as in the instance of the Berlin bottom-ball variety, but the weapon can usually

be distinguished by a metal receiver that has a screw plug on its top surface. Removal of the plug exposes the vertical striker for removal or replacement. The faucet breech also was applied to a large extent to this variety of arm.

One most curious feature of both the butt-reservoir and ball-reservoir varieties within this group is the fact that identical threads are found on the reservoirs, regardless of form. In an emergency, therefore, a butt-reservoir could be screwed on a ball-reservoir gun, and a ball on a butt-reservoir arm. Incongruous as the effect would be, the possibility exists. This leads one to wonder whether one manufacturer was really responsible for all of the air guns within this classification.

Makers are limited, within present knowledge. It is not known whether there were many producers, certainly one can anticipate finding no name on this variety. One example presently available is by Lancaster and includes, beside pump, mold, and miscellaneous equipment, two barrels, one smooth and one rifled, all within a labeled case. An extra case contains two ball-reservoirs. The other, also cased, is by Conway of Manchester (129). A specimen by Thomas Jackson Mortimer, 34, St. James St., London, is identified by illustration (104, p. 304a).

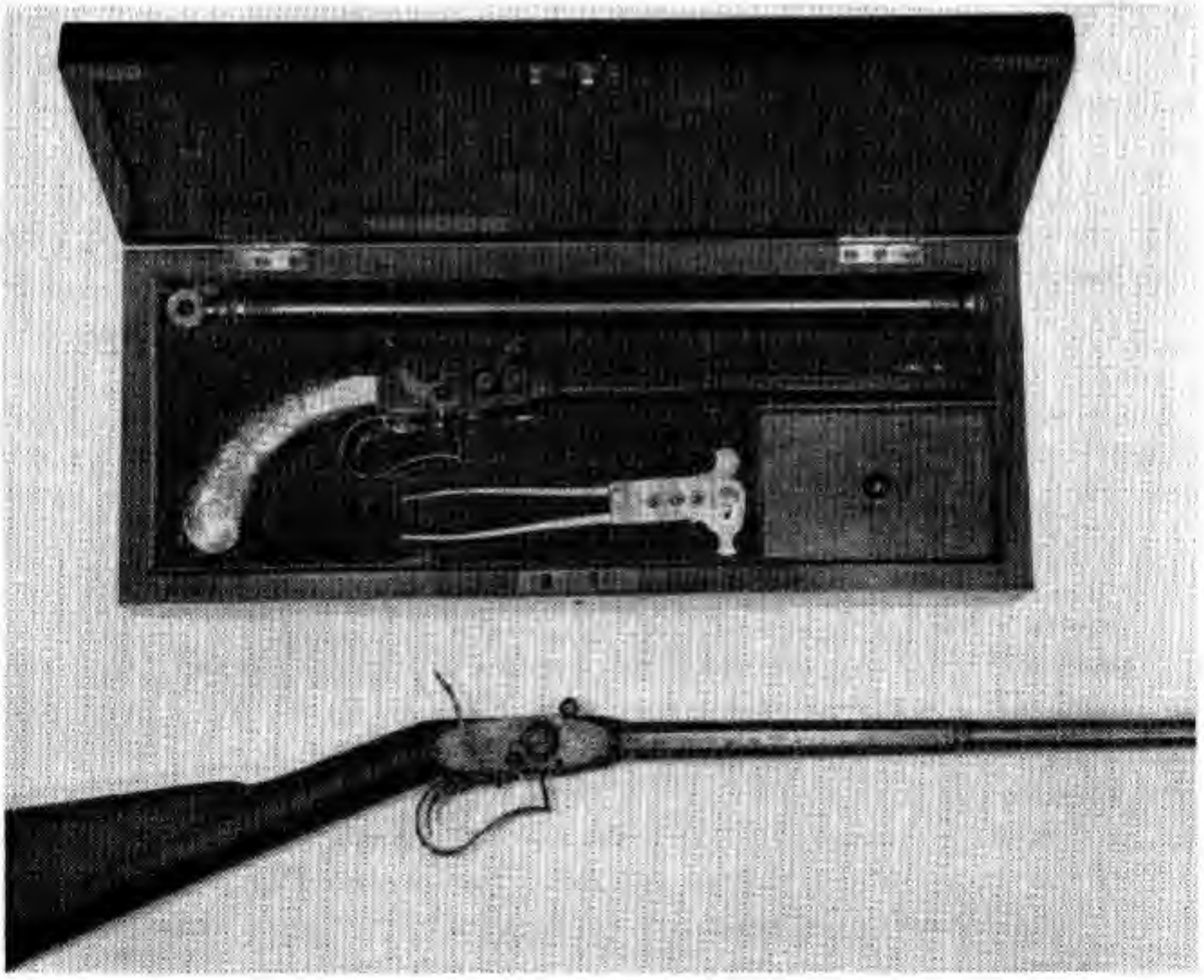

Fig. 59. Back-action-lock Air Guns.
Upper: Hanson (cased).
Lower: Conway.
(Neg. 203357)

One curious variant of the highly developed butt-reservoir air gun is the rear-action lock. The striker (or hammer) is cocked by being pushed forward, not by being drawn to the rear. The rearward thrust to open the valve is taken off the striker above its pivot. All other butt-reservoir guns of the basic Austrian variety take their release thrust below the pivot.

The back-action air gun is one of the big question marks in this story. Who designed it, and why, is not presently known. Two examples that were examined are a pistol by Hanson and a rifle by Conway of Manchester (Fig. 59).

The Hanson pistol has a gold plated butt and is equipped with pump and mold. The faucet breech is operated by a thumb latch on the right side, not on the left, as in the conventional butt or ball types. A curious pin fastening system is present on the trigger assembly which leads one to suspect that the producer was a clock maker, not a gunsmith. A Hanson is listed in one reference (132) as George Hanson, a goldsmith in the assay office of Birmingham, dated 1809, the time of his registration. He was known as "Hanson of Huddersfield." A William Hanson, 1820, Windsor; a Charles Hanson, Huddersfield, 1833; and another Charles Hanson, 160 High Holborn, formerly of Huddersfield, 1839–45, are also noted (32, p. 704). A John Hanson, with William Golden, in a Patent numbered 2129, Nov. 2, 1841, claims, among other things, the " . . . insertion of the projectile (of a gun) by means of a horizontal perforated plug or 'roller', which being turned half around, allows the projectile to be inserted through an opening in the top of the barrel" (2, p. 93). Did one of these produce this unique arm?

The Conway specimen operates on the same principle as that by Hanson. It has a leather-covered butt. George (90, p. 331) lists Conway, Manchester, 1820–1840.

Air Canes

Collectors are given to associating cane guns with novelty weapons. This is reasonable enough in the cases of percussion and cartridge types, neither of which was particularly practical. In the pneumatic weapons, however, the cane became the ultimate as far as effectiveness and general utility were concerned. It was apparently an English development and literally drove all other types from the field.

While the air cane, when carefully handled, is superbly effective, it has been, in our experience, the most treacherous of all air guns. This is because the trigger is not usually guarded. When uncocked, the trigger is concealed; when cocked, it protrudes as a stud.

Most air canes have one form of lock mechanism. Casual inspection does not reveal the intricate nature of the lock, nor does it begin to suggest the jewel-like quality of the interior, which is hidden beneath a coarse casing of painted metal. Few exceptions to the expected lock have thus far been found. As a result, this discussion concerns, unless otherwise noted, the British product.

There is little variation in the essential form of the usual air cane. It is divided into two sections, with the halves united by a screw joint. The front section contains the lock, barrel, breech, sights, and combined ramrod and barrel cap. The pop-out trigger is characteristic as is also the cocking mechanism. The latter has a round port in the casing through which can be seen a recessed square opening in the tumbler. The tumbler is operated by a removable key instead of the normally-expected cocking lever or hammer. This represents the ultimate in the transition of a mechanical member that started out identical to the flint-lock hammer, pan, and frizzen, and gradually lost its original form until it ended as a simple, removable key.

The rear portion of the cane is the reservoir, and is quite standard. It consists of a tube, either twist or single-seam weld in construction, and is customarily capped with a rounded knob of ivory or horn, although this part may also take other forms.

While the mechanical essentials of the air cane are very uniform, the external appearance may vary considerably. In place of the straight, cylindrical reservoir, there may be one shaped as a gunstock, built up and covered to agree with the accepted gun outline, or it may be merely bent into a skeleton form. The straight stock is the most common and can be used conveniently, resting against the cheek, as there is no appreciable recoil when the weapon is discharged, except in unusual cases. One instance is known in which a skeleton stock of wood is supplied, to be screwed to the rear end of the reservoir in place of the usual knob.

Air canes are customarily from ¾ inch to 1¾ inches in diameter, measuring across the valve part in the center of the cane. The weight varies from 1½ to

3½ pounds. There is a noticeable taper to the muzzle in every case examined. One specimen is 1⅝ inches in the center, tapering to 1 inch.

One well-nigh universal feature in English air canes is the screw joint between reservoir and action, this being almost invariably $\frac{11}{16}$–16. This meant considerable latitude inasmuch as the owner of one of these arms could attach almost any butt to the action which he had.

Accessories and finish are also of interest. The exterior of a cane may be either plain or knobbed to simulate rough wood. The more desirable pieces are smooth and are covered with a brownish japan which resembles asphaltum. Specimens are also known in which the finish is a beautiful browned twist. An American example is cloth-covered and enameled black with painted knots. One of the finest appearing cane guns known is done in brown enamel.

Canes were customarily supplied cased. This casing consisted of the box, reservoir, barrel section, pump, foot rest for the pump, bullet mold, and key. Extras furnished in instances, consisted of an auxiliary knob; shoulder stock; shot measure; dust caps for reservoir, pump, and barrel; a handle to screw on the reservoir; extra sets of valves and springs; a wrench for unscrewing the valve assembly; and, in one instance, an extra set of every working part and screw in the gun.

English air guns are quite commonly found with interchangeable barrels, one smooth for shot and the other rifled for ball. From this came the improvement, probably English, of providing a removable liner in addition to the regular barrel in the gun. It is found in at least one instance in a gun dating about 1810. This idea was taken over by the air cane makers, at least half of their products having removable barrel liners. Generally the bore is smooth and the liner rifled, but the reverse is also known. Integral barrels and removable liners are usually of brass. Rifling is poly-grooved, twenty-two or more grooves being the rule. Each groove consists of an arc, producing a total appearance of a finely scalloped bore. This rifling is characteristic of older air guns and seems to result in lower barrel friction between tube and projectile.

Instructions accompanying air guns always state that the bullets should be made of pure lead. These are customarily cast by the user of the gun. In addition, makers also supplied other projectiles, as for instance did E. M. Reilly, who wrote in a sales pamphlet, published about 1850, as follows (200, p. 7).

"Shot cartridges of all sizes, not exceeding sixty gauge, in packets of three dozen, at two shillings; up to forty gauge, two shillings and three pence. They will be found to answer well as now made upon our last arrangement.

"Harpoons with feathers and stout ferrules, not exceeding sixty gauge, nine shillings per dozen.

"Barbs of various patterns from six shillings per dozen.

"Harpoons of larger sizes, and made upon other principles, barbs and points, at proportionate prices.

"It is not advisable to order as many barbs, or steel points of any kind as of harpoons. The velocity with which they are propelled often slivers the wood into pieces on striking a hard surface, though the barb may not be injured; thus four barbs (forked at one shilling each) would probably be a fair proportion to a dozen harpoons."

Another feature unique with air canes is the ramrod, which is attached to a cap that, in turn, is screwed over the muzzle of the piece. The cap serves as a tip to the cane. Normally the ramrod is carried within the bore of the weapon, not within a separate tube or a set of thimbles. Again we can see the unique attempts at simplification and reduction of additional parts.

While many air canes are loaded from the muzzle, regardless of whether ball or shot is to be used, certain specimens are equipped with a loading port at the breech, usable for ball. This mechanism consists of a sleeve with a hole in it which can be rotated transversely. The liner, which is smooth-bored in this case, is loaded from the muzzle. The invention of this feature is indicated by Reilly (200, pp. 4, 6, 12) who calls it his revolving breech. It appears in only one form. There is no known instance of an air cane with a bullet magazine.

Because of the complete enclosure of the essential mechanism of an air cane it is impossible to appreciate the perfection of the product without disassembly. While the exposure of the parts is not difficult, there are certain steps that must be followed in order to avoid damage. For disassembly, therefore, the following procedure is proper:

1. Unscrew the reservoir and *KEEP IT OFF.*
2. Remove the rear sight. This normally can be done by unscrewing the stem base.
3. Remove the front sight. This also unscrews.
4. Remove the cap (with the ramrod), and thereafter the liner if present. Both are screwed in place at the muzzle.
5. Unscrew the threaded ring at the muzzle.
6. Depress the trigger stud and hold it depressed.
7. Tap or push against the muzzle of the barrel, sliding the barrel and the attached lock out toward the breech. It will have been noted that the barrel, before this motion, is free or floating within the cane tube. N. B. If the gun is provided with a rotating port for breech loading, remove the finger stud, which protrudes. It will unscrew. The sleeve will then slip out with the rest of the mechanism removed in step 7.

Reassembly is in reverse of the above. Be sure of correct alinement. If alinement is not correct, do not try to rotate the mechanism while within the cane tube. It is better to remove the parts and try again.

The term jewel has been previously used to describe the lock of a good air cane. This will be appreciated and concurred in by anyone who disassembles

such an arm. The beauty of finish and excellence of design are a constant source of admiration. It is upon the locks that the makers marked their names, initials, and numbers. While these marks are not always present, they will be found on the locks if anywhere.

If the valves are in good order, leave them strictly alone. It is unusual, however, to find the valves in operating condition. Generally they indicate damage due to drying out or to the absence of pressure in the reservoir. In order to keep valves operating properly, a pressure of fifty to one hundred pounds should be retained in the reservoirs. Never under any condition allow an exhausted air gun to stand without replacing at least a part of the pressure. Frequently valves that leak a bit under low pressure re-seat themselves when the reservoirs are well filled.

Never screw the reservoir on an air cane while the gun is cocked, as the trigger will almost certainly be depressed in the assembly. When putting the reservoir on any air gun it is a good precaution to check the discharge pin of the lock to be sure that it is free. If it is not free, the contents of the reservoir will be discharged in one blast during assembly.

The following makers of air canes, or parts for them, have been found listed in advertisements, on labels, or on locks.

BARNES, FREDERICK & CO. LONDON

A fine English air cane, cased, has been examined.

BLANCH, JOHN LONDON

A cane-type gun having a sharkskin-covered butt is known. It is marked as made by John Blanch and Son, 29 Gracechurch Street, London (179). "John Blanch, 39 Fish Street Hill, London, London Directory, 1812, took son into business, 1848" (28, pp. vii, x).

CHAPEL, A. E. LIVERPOOL

One specimen reported (149).

COGSWELL & HARRISON ENGLAND

Mentioned as air cane maker (244).

COOK ENGLAND

An example is at hand marked "COOKS PATENT 266." A spiral (coil) spring activates the lock. This type has the key turn 180° to cock instead of 90° as in ordinary air canes.

DEMON GUN WORKS BIRMINGHAM

(See Midland Gun Company.)

FLETCHER, THOMAS LONDON

A superb cased set has been examined (Fig. 60), which contains a complete cane, pump, wrenches, and spare working parts. This is the finest example yet encountered.

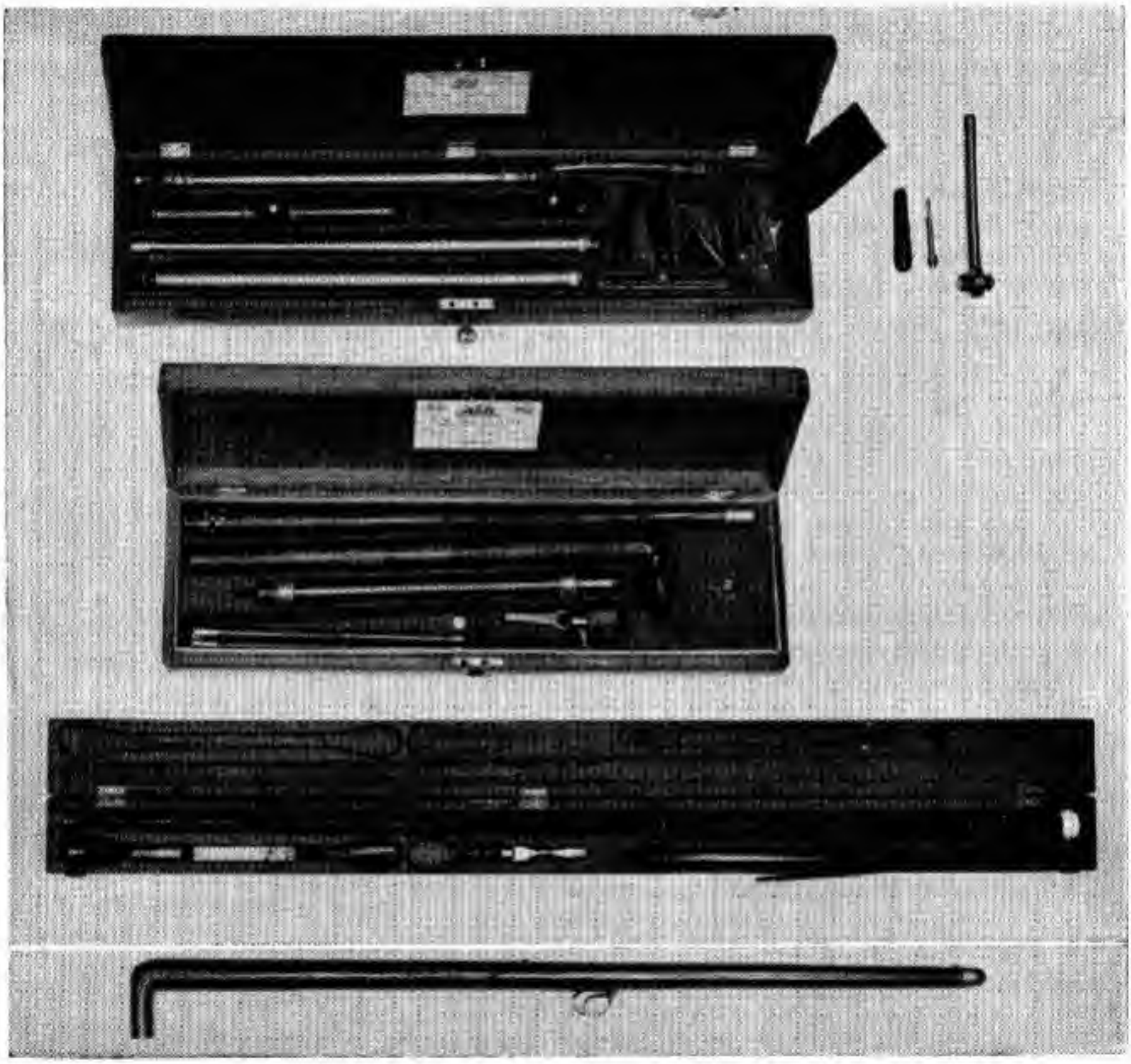

Fig. 60. Cased Air Canes.
1st. Fletcher.
2nd. E. M. Reilly (from the Brown Collection).
3rd. Unmarked.
4th. Air cane with trigger guard, unmarked.
(Negs. 203338–9; 4th., Nunn. No. N5758)

GASQUOINE, W. MANCHESTER (10 Market Pl.)

This name is engraved on the barrel of an air cane pump. The cane is marked James Kerr & Son (129).

GREENER, W. W. 68 Haymarket, LONDON
Works: St. Mary's Square, BIRMINGHAM

Greener (102, p. 774) claims that the first English-made air guns and rifles were produced by him. He also allows that two other makers are producing air guns in England, both for home and export trade. An advertisement dated 1892 illustrates an air cane, accompanied by a pump and key. The reservoir is bent into a dropped skeleton shoulder stock. Prices quoted are 55s., 60s., and 98s. If breech loading, 8s extra.

HARROLD, F. W. PHILADELPHIA, PA.

A receipt book of the Krider Gun Store (203) has the following entry: "Rec Nov 7 1851 of Mr. John Krider 15 21/100 dollars in full for one air cane gun.

F. W. HARROLD
Per I Field"

Harrold may have been a maker or merely the seller of an air cane. He is not found as an English maker. Nothing is known about the cane noted above.

KERR, JAMES & Co. 54 King William St.
LONDON ARMOURY LONDON

A set (129) by this maker contains, in an oak box, the following: two parts of the cane, pump, pump foot rest, wrench, key, and wad cutter. A label in the box reads:

"LONDON ARMOURY

Established 1854

James Kerr & Co.
Manufacturers of Sporting Guns
Rifles & Revolver Pistols,
and Adams' Revolvers as Supplied
to H.M. War Department.

Military Arms of Every Description,
Ammunition and Implements.

54, KING WILLIAM ST. LONDON BRIDGE"

The barrel of the pump is engraved GASQUOINE, which see.

KUNZ, J. PHILADELPHIA, PA.

An air cane has been examined, bearing this name on the lock plate. The cane is equipped with a curved handle. The lock differs from the English variety in a number of respects and is, without much doubt, American. If it is English, it is unique. The ramrod is carried in a separate channel instead of in the barrel. The cane is cloth covered (Fig. 63).

LEWIS, G. E. 32 & 33 Lower Loveday St., BIRMINGHAM

The pump accompanying an air cane is so marked. The pump cylinder is of damascus twist. See Townsend.

LONDON ARMOURY LONDON

See Kerr, James & Co.

MIDLAND GUN COMPANY Bath Street, BIRMINGHAM

A sales list dated 1924 (175) notes the following:

"PUMP AIR CANE. Very powerful and almost Silent in Use.

No. 5480—Air Cane Gun, with rifle and shot barrels, complete with pump, key, mould, and shot measure. Price £ 5-5-0.

No. 5492—As above, but with rifle barrel only, with pump, etc. complete. £ 4-10-0."

REILLY, EDWARD MICHAEL LONDON

The advertising pamphlet, dated 1850, referred to previously (200) is titled as follows:

"AIR GUNS, AIR CANES, and AIR WEAPONS

Of every description, upon an improved construction, divested of complication, and adapted for Shooting with Ball, Shot and Harpoons, in numerous sports and amusements, by

REILLY, JUNR., No. 502 NEW OXFORD STREET, LONDON,

Manufacturer of all kinds of experimental work for condensing and retaining condensed air. Valves to any Pattern. Pumps of every dimension. Fine Twisted Iron Welded Reservoirs. Pumping Machines, &c.&c."

In this brochure there is found an amazing amount of information regarding the air cane. Its construction, operation, development, and list of varieties and prices are given. Prices range, depending upon material, quality, and finish, from £ 2-15-0 to £ 8-18-6, including accessories. A Reilly specimen has been reported with Staudenmayer patent credit on it (62). A specimen was examined (Fig. 60).

STAUDENMAYER — Cockspur St., LONDON

A walking stick air gun with detachable pump has been reported (10).

TOWNSEND, J. — BIRMINGHAM

W. Greener, in "Gunnery in 1858," states (22) :

"JAMES TOWNSEND
11 & 12 SAND STREET, ST. MARY'S SQUARE
BIRMINGHAM

Manufacturer of

AIR GUNS, AIR CANES, AND
AIR WEAPONS

of every description, upon an improved construction, adapted for numerous Sports and Amusements, viz:—Killing rabbits, Rooks, Sea Fowl, etc., with ball, destroying vermin, small birds and collecting rare specimens with shot, and fish near the surface of the water with harpoons and lines."

An otherwise unidentified air cane has been found to bear the mark "J. T. 9164." Another, also a muzzle loader, having a rifled liner, bears the mark "J. T. IMPROVED 8010." A breech loading piece is marked "J. T. IMPROVED 5210." The last two represent two barrels accompanying one reservoir. An air cane with a shaped reservoir bears the mark "J. T. 12764." The accompanying pump is marked "LEWIS," which see.

WILSON, JOHN & CO. — LIVERPOOL

Three air canes were offered for sale at various times, with cases, bullet molds, bullets, keys, and pumps (3; 31; 236).

The Giffard Story

Paul Giffard of Paris, France (1837-1897), bridged the gap between Rasmussen's idea in 1834 and the realizations of Crosman and others of the present day in the use of CO_2 as a propellant for guns. Aside from the guns themselves there is the story of the idea as well as the variety of applications of the pneumatic principles involved, of which, in the instance of Giffard, the gun is only one example.

While the use of carbon dioxide as a propellant in guns is not specifically stated, the record of Peder Rasmussen's work leaves no other possibility. Arne Hoff (122, p. 25) says, "After his return to Langeland in the autumn of 1834 he immediately set to work . . . a gun which was in the making, but not finished as yet. Instead of gun powder for this gun he intends to use a sort of *steam* or *gas* to be *generated* from a *special substance*, without the use of fire, *by the temperature of the atmosphere alone*. He hoped to be able to load into the gun, at a time, so large quantities of the substance in question as to suffice for *several hundred shots*, and regularly to fire 20 to 30 rounds a minute. Furthermore the gun has only one barrel but an iron butt like that of an air gun; it weighs 11 pounds in all." (Italics are mine.)

The substance in question, when the description is analyzed, could be nothing else than carbon dioxide snow, or as we know it today, dry ice. In substantiation of the theory of knowledge of dry ice at that time, The Encyclopaedia Brittannica (70) states that in 1834 a certain Thilorier succeeded in liquefying CO_2 and, by properly releasing the liquid, produced a solid, actually dry ice. This material was quite new and so also was the idea of using it in a gun.

Rasmussen's gun was apparently never successfully completed. At least nothing more is heard about it or anything similar until "Giffard's New Gun" appeared. Even this was not spontaneously generated, but grew from the usual air gun.

Paul Giffard, the brother of Henry (Henri) Giffard was an independent inventor at least the equal of Henry, in some respects the superior. Henry was a recognized student of navigable balloons and was the inventor (in 1853) of the well-known injector for steam engines, a revolutionary device that accomplishes the impossible by injecting water into a steam boiler against the pressure of the steam therein, employing that same steam pressure to accomplish the feat. A reference that is the basic source of much of the personal history of Paul Giffard (91), claims that the invention of the injector was the result of cooperation between the brothers. This source, which attempts to build up Paul, may reflect a tolerance on the part of Henry, whose reputation was already excellently established. It is curious to note, in this connection, that the Giffard brothers are either not listed at all in reference works or else are casually noted. Even Brockhaus (33, Giffard), a publication rather contemporary with the brothers, under the heading "Giffard," merely notes Henry Giffard as a French engineer of airships and captive balloons.

Among the inventions which are claimed for Paul are the refrigerator, or "cold air machine," of which a glowing account is furnished, with claims that it is a priceless means of preserving meats and a great financial boon, particularly to England. Paul Giffard is credited with over two hundred patents, "covering inventions in almost every branch of science, and he has devoted much of his time to the successful study of problems affecting the use of compressed air . . . " He was the inventor of the universal piston, vacuum apparatus, and engines for compressing and liquefying gas.

Perhaps this genius' greatest, or at least best known invention is the pneumatic telegraph, by means of which messages could be sent by compressed air through tubes. In 1872, and for several decades thereafter, this device was used in Paris. According to Brockhaus (33), under the title "Pneumatic Telegraph," the device is described as one in which air pressure within pipes serves instead of electricity, the operation being uniform over the entire system. The reference, which is dated 1895, states that, while employed to a considerable extent in a variety of places, the pneumatic telegraph was even then on its way out, the competition with private telegraph lines of the electrical variety being too great.

With such a background of interests and accomplishments, it is not surprising to find that Paul Giffard produced a number of improvements in pneumatic arms which have survived to this day.

The first of the series (Fig. 61) is a gun that was patented in England in 1862, and in the United States in 1864. (92; 93). In this device, which consists

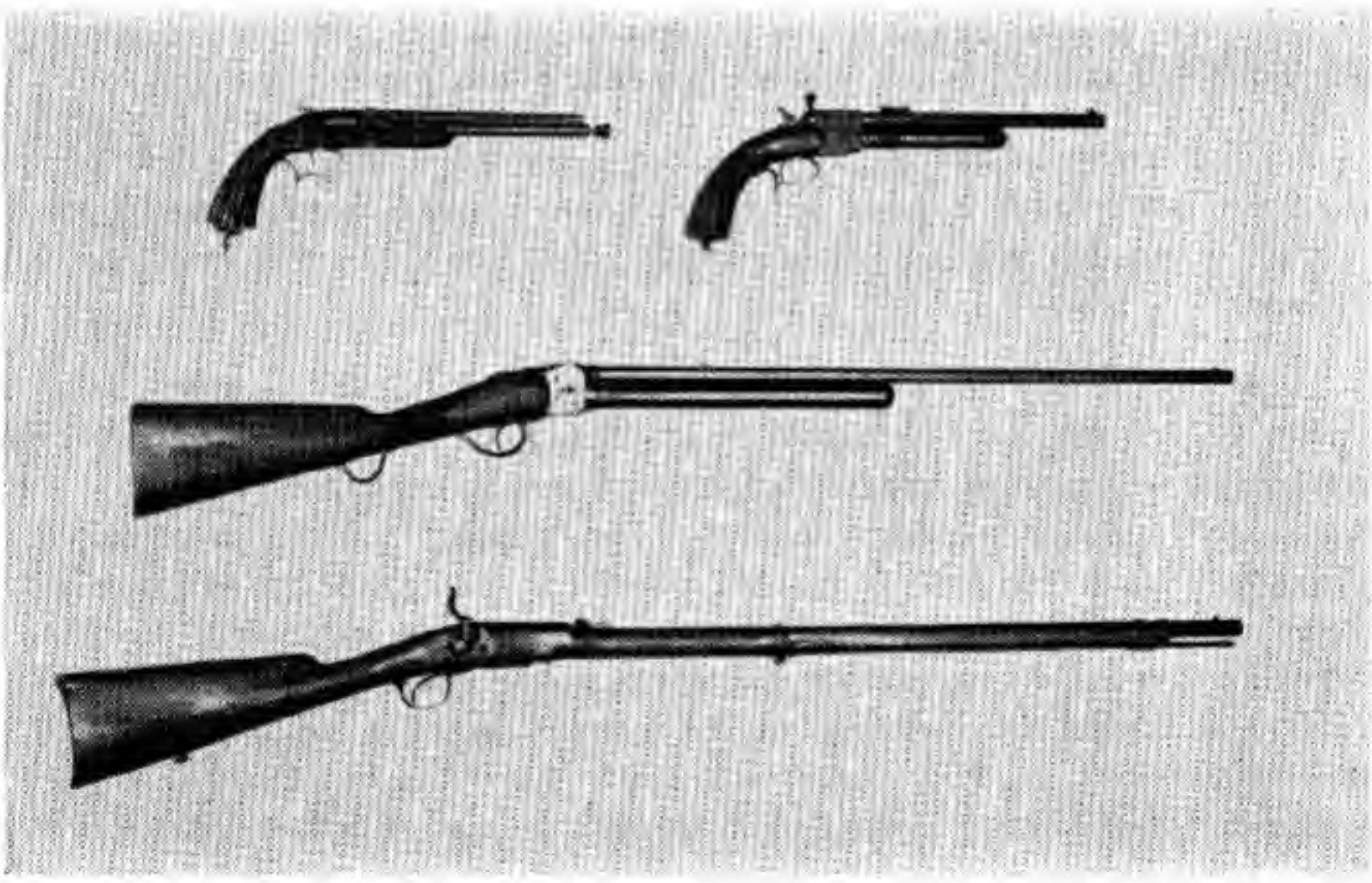

Fig. 61. Giffard Guns.
Upper left: Air pistol with straight-line pump.
Upper right: Gas pistol with forestock reservoir.
Middle: Gas rifle with forestock reservoir.
Lower: Gas cartridge breech loading rifle.
(Neg. 203659)

of a normal-appearing arm with straight-line pump and reservoir below, and a faucet breech in line with the bore, a new form of pressure release appeared. Whether or not Giffard followed the lead intentionally, the valve was an improvement on that patented by Gedney (88), in which pressure for a toy pop gun was produced by squeezing a rubber bulb grip until the pressure popped the valve, releasing the pressure and shooting out the projectile. Giffard merely set the release valve with what looks like the hammer of the gun, thus locking a pop-out valve. Pressure is attained by pumping. Loading is via the faucet breech. Shooting is accomplished by squeezing the trigger, which merely frees the hammer, whereupon the rearward action of the valve, which has been under pressure up to this time, tilts the "hammer" into forward position by its (the valve's) rearward thrust. The blockade thus being removed, the valve moves back and the pressure escapes. No heavy hammer thrust is needed to open the valve. The action was unquestionably very easy and smooth.

A pistol of this description that has been examined has a forward facet of the reservoir marked "P. GIFFARD BREVETE." The gun is numbered "33." The internal mechanism is in agreement with the patent but adds the information that the valves and pump are bushed with leather, meaning leakage of pressure.

With the experience afforded him by his air pistol and, in all probability, additional investigation into the remarkable pneumatic arms that were developing in England as a result of the fusion of previous knowledge on the continent, Giffard produced his gas gun. This appeared in both pistol and rifle sizes.

Within the basic form that had the removable forestock-reservoir, which was patented in the United States in 1873 (94), it would appear that Giffard made one type of pistol and two of rifles. A pistol and one rifle have been examined; the other rifle is known through an illustration (91). How many other models were made, based upon this form, is not presently known.

The pistol is provided with a rotating bolt which, in upper position, exposes a port for loading. It is really a form of the faucet breech that Giffard specifically noted in his 1873 patent. A rebounding hammer forces a driving rod forward, thus opening the valve in the reservoir and, thereafter, allowing it to return enough to permit the valve to close. According to the patent an adjustable stop controls the forward thrust of the hammer, and thus the amount of gas used per shot. In the pistol this stop consists of a bolt that can be screwed to the rear, preventing a complete forward movement of the hammer.

The specimen is marked, "MANUFACTURE FRANCAISE D'ARMES ET CYCLES DE SAINT—ETIENNE." The hammer, in rebounding, does not follow a spring or lever as might be expected, but, being free to return a bit to the rear from its forward thrust, is pushed back by the driving rod, which in turn is actuated by the valve of the reservoir. Actually the gas pressure within the reservoir helps push the hammer to rest position.

It is marked "221" in several places, "ACIER" on the barrel at rear left, and "CAL. 4.5" at the rear sight. The reservoir weighs 156 grams empty and 175

grams when filled, according to marks on it. The tubular portion and the removable valve portion are marked "88."

The rifle, which follows the same basic pattern as the previously described pistol, is marked, "THE GIFFARD GUN COMPANY LIMITED LONDON," and is numbered "5102." The reservoir bears no marks aside from those that apparently developed when somebody tried to take it apart.

The Giffard brochure previously alluded to (91) includes an illustration of a similar rifle and identifies it as "A gun shooting three hundred shots without reloading." Inasmuch as no bullet magazines are in evidence in either specimens or printed matter, it must be assumed that the number alluded to the gas-reservoir capacity. The above noted rifle, British, has a counting device built into it that is readable by a righthanded person when he glances onto the right side of the receiver from the top. The highest number, 200, refers to the available number of shots with a new gas-reservoir. Thereafter, each tenth shot is registered by means of an internal gear mechanism, following from 190, 180, etc. to 10. The device then starts afresh.

The mechanism is lever-operated, the movement cocking an internal hammer, operating the counting device, opening the breech at the top for loading a bullet, and placing the lock on safety, using a shotgun-style wrist safety lug. The previously noted adjustable stop for the hammer, regulating the intensity of discharge, is not present.

Another item in the Giffard line is a military-style rifle with removable cartridge. The arm is marked at the top of the receiver, "PAUL GIFFARD INV^{R} B^{TE} PATENTED." The only number so far found on the piece is "15," which is stamped into the sear bar holding the tumbler. With no other member bearing a number, it must be considered possible that this bar was adapted to its present use from some other outside source.

To use the term odd, or curious, might appear redundant to those readers who have followed the advertisements of dealers who have occasionally had air guns for sale. But here the terms are factual.

The gun is opened by unscrewing the barrel from the receiver, a bit more than one turn being sufficient. The one turn of threading that holds the units together affords as much or as little strength as appears to have been necessary in other air guns of the past. The barrel fits into a sleeve that is hinged to the receiver. When the barrel is unscrewed, it tilts downward and away from a recessed chamber within the receiver.

A lock, which is quite normal in external appearance, actuates a driving rod within the receiver, and this rod is forced forward as the hammer descends beyond half-cock, but returns when the hammer is again retracted.

The cartridge for the gun, one of several similar patterns, is a replaceable miniature gas reservoir with spring-valve. It is placed into the chamber of

the gun in a manner reminiscent of the Burnside, with the valve opening toward the rear. Three fins or vanes, which are fitted longitudinally to the cartridge case, separate the cartridge from the walls of the oversized chamber. A bullet is inserted into the breech of the barrel and the barrel tilted upward and screwed into place—AFTER ascertaining that the hammer is on half cock, which is safe. If the hammer is down, the driving rod can readily force open the valve within the cartridge as the barrel is being screwed into place.

Presuming that the gun is in correct order and properly prepared, the descent of the hammer from full cock forces the driving rod forward, opening the stem valve within the cartridge case. The confined gas therein, thus released, passes through the valve opening to the rear where, being deflected by the bottom of the chamber, it expands and proceeds toward the forward end, passing through the space provided between cartridge and chamber by the fins. This passage of gas ultimately forces the bullet out through the barrel. A new cartridge is needed for every shot. An adjustment screw at the base of the chamber keeps the cartridge from seating too much to the rear. This specimen appears to be a model only and, according to patent dates, fits between the straight-line pump and the forestock-reservoir forms.

The Giffard gas gun appears to have taken the imagination of sportsmen by storm. The reflection in America is illustrated by the article in The Sporting Goods Gazette (220) in which it is identified as a French repeating air rifle, called the "miracle gun." Its description coincides with that of the reservoir rifle previously noted. The cheapness is also stressed, the gun costing about five dollars, and the removable reservoir, containing enough CO_2 for three hundred shots, costing about 2½ cents per refill.

Nor did this end the enthusiasm. The same magazine, six months later (218), stated, "It is reported that the Colts, of Hartford, have bought the American rights to the Giffard gun patents for $1,000,000 . . . " Thereafter follows the usual description and glowing account of efficiency and low cost. There is no indication that Colts of Hartford ever did anything about the matter.

The presently produced CO_2 guns are, of course, descendants of the earlier Giffard weapons. The curious fact remains that Giffard, while he has become famous as the maker of the gas gun, included gas as a possible variant of air, and appears to have held to the term "air gun" for his product. The first form was the straight-line pump pistol which required separate pumping for each discharge (92; 93). The British patent of 1872 (96) covers both the removable individual cartridge and break-down rifle in which it is used. The ultimate, represented by the forestock-reservoir pistol and rifle, was the last in the series, as far as is presently known (94). The patent that was granted the same day as the forestock-reservoir one, covering an air cane (95), is not represented, to our present knowledge, by any manufactured example, although Wesley (249) indicates that, even though he personally never saw any, a few air defence canes were made.

An article by Harrison in the Gun Report (105), is suggested as supplementary reading.

Pump-In-Butt Air Guns

The air gun with a pump in the butt but without a barrel-surrounding reservoir brings forth difficult questions of genealogy and development. Three examples have been made available, so similar in form and mechanism as to lead one to wonder how well established the type really is.

Similar to the barrel-surrounding reservoir air guns, the present type has a pump located in the butt, the piston of which is operated through an opening in the butt plates. The reservoir, however, is a small one and is located within the wrist of the arm. Two valves are present as in the case of the barrel-surrounding and transitional types.

Similar to bellows guns and certain examples of butt-reservoir weapons, the arm is provided with a flip-up breech. Fine sighting equipment is present and the overall finish is in high taste. One example is even equipped with a sling.

No external hammer is in evidence. What appears to be a double set trigger is in reality cocking piece and trigger, the rear setting, and the front releasing the lock.

Three names are present on the examined specimens. One is Allger in Zell (Fig. 62). Inasmuch as an assortment of Zells is found from Hanover to Switzer-

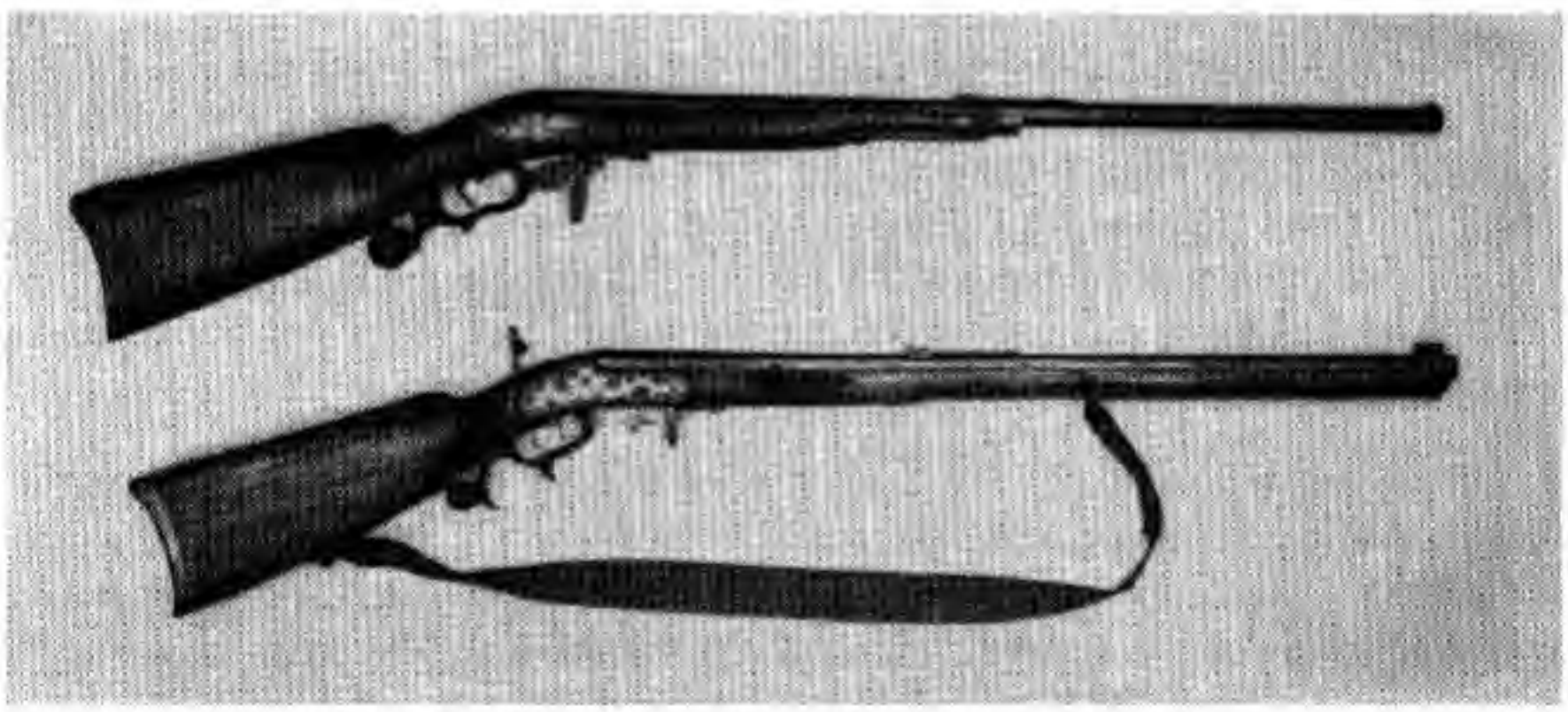

Fig. 62. Pump-in-butt Guns.
Upper: Rieger, Munich.
Lower: Allger, Zell.
(Neg. 203351; lower, Nunn. No. N10601)

land, the specific origin cannot be definitely assigned. The other two: Ernst Bischoff of Augsburg and Rieger of Munich can be assigned geographically. Because of the similarity in the mechanism of these guns it is suggested that the "Zell" noted may be the one in Austria, about eighty miles south-east of Munich.

American Pneumatic Arms

At a time when most of the finer things of life came to this country from Europe, it was inevitable that certain firearms and air guns would find their way here and be imitated by our craftsmen. It is equally obvious that craftsmen coming to this New World, would bring their old styles and techniques with them. While many of the air guns used in America in the 18th and early 19th centuries could be expected to be foreign products, or local items indistinguishable from them, certain American gunsmiths adapted English or Continental designs and thereupon produced local forms of the air gun, in instances essentially Kentucky air guns. Although few specimens exist, three forms of domestic products have been observed. The first is a typical Kentucky rifle in external form, having a ball-reservoir; the second type substituted a formed iron reservoir for the buttstock; while the third had a pump under the barrel and a reservoir in either the butt or within the wrist of the stock. The first two forms had detachable pumps.

Philadelphia appears to have been a center of air gun making. Lukens and J. Kunz, both of Philadelphia, marked their products. The former name appears on a butt-reservoir air gun and the latter on an air cane.

The Lukens gun (Fig. 63) has a formed iron butt-reservoir (once painted black), brass receiver, octagonal brass barrel, full-length walnut forestock, German-silver thimbles, and hickory ramrod. The face of the muzzle is decorated with eight punched dots, each enclosed within a circle. Rifling consists of seventeen scallop-shaped grooves. This latter follows the best air rifle design instead of the conventional Kentucky rifling that was the recognized type in America at the time.

The striker consists of a flint-lock hammer with a lug that is held in the jaws of the cock. This offset lug, in falling, engages a striker bar which protrudes vertically through the receiver. The latter bar is thereby tilted forward to the point where the member in the hammer jaws passes over it. During the period of contact the tilting piece opens the valve in the reservoir and, when the contact is ended by the hammer lug passing completely beyond the tilting striker, returns to normal position, permitting the valve to close. While its appearance belies it, the mechanical principle is identical to that of the outside-lock guns.

The flint-lock hammer, which has been suspected as possibly a later replacement, is from a U. S. martial pistol, model 1836. It is identical and interchangeable with others of that model. The hammer does not, however, have the normally expected government inspection mark upon it. The lug held in its jaws is reminiscent of the member employed in one type of alteration from flint lock to percussion (174, pl. 23, no. 1).

The ball reservoir "Kentucky rifle" (Fig. 63) is of unusual interest. That it is a Kentucky is attested to by its form and fittings. Whether the air-discharge mechanism is American remains a matter of question. The lock is essentially the

Fig. 63. American Pneumatic Air Guns.
1st. Ball-reservoir Kentucky rifle.
2nd. Kalamazoo.
3rd. Kunz.
4th. Lukens.
5th. Bouron.
(Neg. 203277)

same as in the bar-lock guns discussed previously, having, however, a rebounding hammer. Another Kentucky-type air rifle has come to our attention through a photograph. Nothing more is known, but at least two weapons of this same basic pattern are in existence. It would be interesting to determine just who produced these pieces.

Among other Philadelphia air guns are the ones produced by the Kentucky rifle maker, J. Kunz (Fig. 63). One of these is reported as having a butt-reservoir, details incomplete. Two references at hand may be to the same arm (237; 232). An even more surprising product of this maker is an air cane which, for consistency, should probably be called a "Kentucky air cane." This is the only one that has to the present come to our attention. While it follows, in its general construction, the conventional English product, there are numerous differences that are worthy of comment. In shape the cane is different, having a cylindrical reservoir bent into the form of a crook handle. The lock is marked "J. Kunz philada," and has definite variations from the English type. One peculiarity in this specimen is that, instead of it having a wooden ramrod resting within the barrel and attached to the tip of the cane, a brass ramrod is present, resting within a separate channel placed below the barrel. It is interesting that Kunz, in the air gun, followed the English type of poly-grooved, scallop-shaped rifling in-

stead of the accepted Kentucky type. This cane differs in one additional respect, being cloth covered instead of having the enamel applied directly to the metal.

A curious triangular cardboard box, containing an air pistol, is marked, among other things, "Patented June 1, 1869." This refers to the patent granted to E. H. Hawley (199) covering the Kalamazoo air pistol (Fig. 63). The arm is a true air gun which anticipated later (now discontinued) forms by having a longitudinally acting pump under the barrel. In recent years the forestock lever pump, which is a decided improvement, has been employed.

The reservoir is a hollow iron pistol butt and the striker that releases the pressure is very consistent with the times by looking just like a percussion hammer. The reservoir has a screw plug of lead, which presumably has been fitted into a core opening that was needed in casting the reservoir.

In an advertisement (99) dated 1870, P. C. Godfrey states this testimonial. "My pistol shoots splendid. I use bullets and shoot squirrels. Have killed 7 squirrels at 8 shots with it." In our opinion, either the American squirrel has toughened up considerably in recent years or else the testimonial is a gross exaggeration.

The best publicized early American air gun was that referred to eighteen times in the journals of the Lewis and Clark Expedition of 1804–06. The almost universal comment marked the astonishment of the Indians throughout the trip whenever the weapon was demonstrated. Such demonstrations appear to have been more or less of a ritual at meetings with the Indians. Unfortunately, the entries do not describe the gun in sufficient detail to permit positive identification. One reference (153, v. 7, p. 98), is puzzling, inasmuch as it says, "The black Smith fixed up the bellowses and made a main Spring to Capt. (Lewis's) air Gun, as the one belonging to it got broke."

From this it would appear that the air gun referred to was one of the peculiar bellows guns that were the product of southern Germany and never, as far as we presently know, used elsewhere. The reference most likely means that the smith repaired his own bellows. The astonishment of the Indians when shown the bellows bears out this possibility. It is beyond the bounds of reason to presume the use of a bellows gun on the expedition, inasmuch as the performance of such an indoor target weapon would not have astonished anyone, not even an unlettered native; nor could it, as is suggested in another place(153, v. 1, p. 242), kill a deer. A footnote (153, v. 1, p. 242) in the edited journals gives the best indication as to the type of this weapon. "The Indians admired the air gun, as it could discharge forty shots out of one load . . . " If this observation is accurate, it is evident that Captain Lewis' air gun was of the pneumatic type with either a butt or ball reservoir. Whether it was of American or European origin cannot be determined.

One entry in Captain Lewis' Journal (154), the first one that refers to the air gun, describes a dramatic occurrence. " . . . being invited on by some of the gentlemen present to try my air gun which I had purchased brought it on shore

charged it and fired myself seven times fifty five yards with pretty good success; after which a Mr. Blaze Cenas being unacquainted with the management of the gun suffered her to discharge herself accedently the ball passed through the hat of a woman about 40 yards distant cuting her temple about the fourth of the diameter of the ball; shee fell instantly and the blood gus(h)ing from her temple we were all in the greatest consternation suppose(d) she was dead by (but) in a minute she revived to our enexpessable satisfaction, and by examination, we found the wound by no means mortal or even dangerous . . ." There should be no question, after reading this quotation, that the arm referred to was a true pneumatic weapon and not a bellows gun.

One wonders, when the entire story is told, whether the "Kentucky" air gun previously referred to is actually the gun used by Captain Lewis. If we presume that the blacksmith repaired the reservoir, i.e., the member that held the air, or as Lewis may have put it, the bellows, it would have been worthy of the note in the expedition's journal. Would Lewis have had occasion to employ the word "reservoir?" His record is very simple and direct, so he could, in searching for a word, have referred to the globe as the bellows because of the effect that its use produced. The reservoir of this Kentucky air gun has been repaired and, in our opinion, very cleverly. Such a repair in the field, without the equipment expected in a regular machine shop, would be really exceptional, and raises an unanswerable question, along with the additional question of an attached magazine for bullets, which may be read into the incomplete accident account.

Articles by Harrison in the Gun Report (108; 109; 110) are suggested as supplementary reading on the Lewis and Clark question.

An unconfirmed report (253, p. 26) credits a certain Peter Ballou (see Page 22) with the manufacture of an air gun as a sample of a proposed weapon for arming the Continental army. In view of Benjamin Franklin's oft-quoted suggestion (82) of arming the military with bows and arrows, it is perfectly possible that the air gun was suggested for this purpose, particularly in view of the stringent powder shortage. On the other hand, we cannot neglect the possibility of confusion in spelling and the resulting uncertainty in identification of both individual and date, as discussed on Page 22.

With the development of the percussion lock, the ingenuity of the American inventors seems to have been pretty well taken up with firearms. The pneumatic gun therefore appears to have been laid aside or forgotten except as a toy or, as is developed elsewhere in this work, as a gallery gun. An interesting exception is a pneumatic dart gun by P. Bouron of New Orleans, listed in the city directory for 1853 as P. Bourbon (46). The gun has a pump and a reservoir in a large tube below the barrel, giving it somewhat the appearance of an over-under shotgun (Fig. 63). It also somewhat resembles the Benjamin, Crosman, and other air rifles of the present.

That some imports of foreign air guns were made during the middle of the nineteenth century is indicated by the advertisement of Fifield and Richardson of

Boston, Mass., which appeared in that city's 1853 directory (30), as follows:

" . . . a good assortment of double and single guns, gun canes, air canes, and saloon pistols, of English and French manufacture."

A reference to a cane air gun is found in a receipt book of the Krider Gun Store, Philadelphia (203) in which it is stated that one air cane gun was purchased for $15.21 from F. W. Harrold. Who the man was or what the origin of the item was is not noted.

Miscellaneous

Fortunately, aside from such modern air guns as we have included elsewhere to give an impression of what has been done very recently, there are few examples which defy classification. Without further introduction, therefore, a select group of curiosities is herewith presented, some of them really amusing.

The pieces illustrated in Fig. 64 are hybrids, in a way, basically ball-reservoir examples, but either out of time or place.

1. This ball-in-butt-reservoir air gun (marked "Davaston") appears to be the erratic dream of somebody who wanted to make a better air weapon. A normal ball-reservoir is held within the butt, the rounded sides of the ball protruding like

Fig. 64. Hybrids—out of time (basically ball-reservoir guns).
Upper: Ball-in-butt, Davaston.
Middle, left: "Baton."
Middle, right: Bouillet.
Lower: Crosman "ball" reservoir.
(Neg. 203349)

well-filled cheeks. The air is expected to proceed through a rather long passage to the breech of the gun when a lock-driven rod moves backward to open the valve. Mildly put, the efficiency of such a device is doubtful. In addition, the side-protruding ball in the butt makes holding very difficult, not to mention the fact that the lack of drop in the stock makes aiming utterly impossible.

2. Here is indeed a fearsome device, an air gun built into a baton. It is unmarked and gives no indication of either origin or use. Inasmuch as the valve-release mechanism is within the ball-reservoir, it has been impossible to determine with any degree of assurance just how it works—if at all!

3. Of all the air guns ever examined during the progress of the present study this ball-in-butt-reservoir air pistol by Bouillet is the most unique from the standpoint of complexity, design of parts, and possible use. In an attempt to discover how it operates the weapon was disassembled. A total of one hundred and seven parts was counted, consisting of fifty screws, pins, and similar fasteners, sixteen springs, and forty-one other parts.

The gun is loaded (the reservoir presumably being filled) by partially revolving the barrel section, which operation cocks the hammer, presents a bullet to the breech within the receiver, and, simultaneously, brings down a concealed trigger.

There is a similarity between the Bouillet and the Lorenzoni turning-barrel gun, as pointed out by Dr. Hoopes (127), for which reason he suggests a date after 1722 for the air pistol. Gardner (87) is in agreement, listing the brothers Jean and Nicholas Bouillet as St. Etienne and Paris, active 1715-62. Demmin (58) locates the brothers at St. Etienne, where he says they were armorers during the reign of Louis XV, 1715-1774. They were reputed to be celebrated for their air guns.

4. Few people have ever seen a ball-reservoir Crosman air rifle. True, the ball is definitely elongated, but it is removable for filling and serves just as did the older globe-reservoirs. Compressed carbon dioxide is to be introduced and the reservoir screwed to the gun, where it presumably remains until empty, although it can be removed for convenience. The arm is an experimental step toward the recently produced "CO_2" rifles and pistols. In the latter forms the compressed gas is carried in a similarly shaped cylinder that is attached to the muzzle end in the course of filling the gun reservoir. The barrel and reservoir give the impression of being an over-and-under double gun. Except for size and the obvious difference in design, the CO_2 pistol and rifle are identical. Here is a curious return to the double-valve reservoir, one for entry from the removable CO_2 tank, the other at the breech for discharge. Compressed carbon dioxide arms have one definite advantage over the forestock-pump varieties, inasmuch as the shooter is not exposed to the exhausting job of pumping the gun for each discharge. If the variable valve is properly adjusted, one filling of the reservoir serves for about seventy shots. Since ten fillings of the reservoir are possible from a cylinder, the removable tank has sufficient gas within it for possibly seven hundred shots or more. Pressure is remarkably constant until the point is reached when the reservoir is

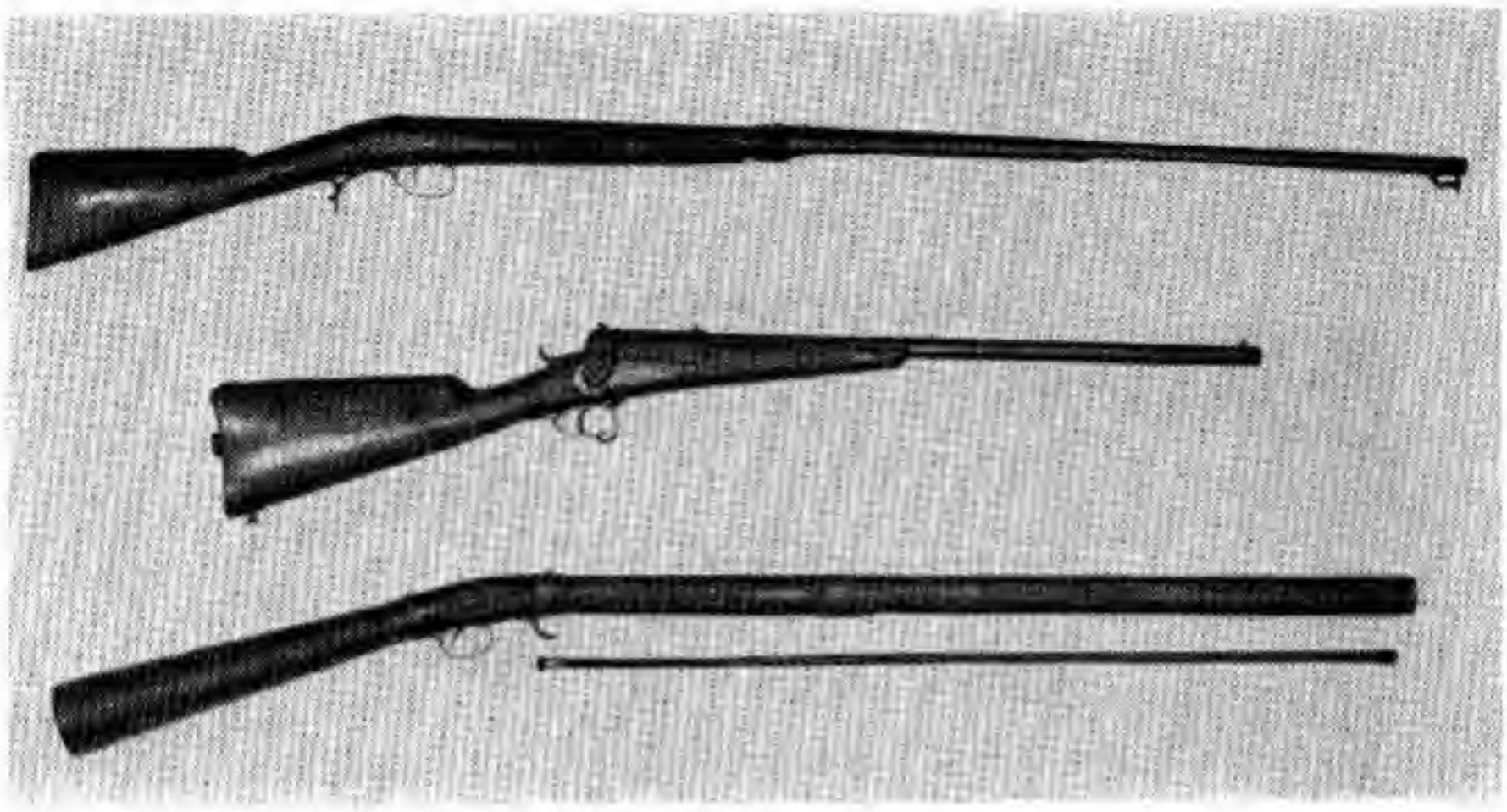

Fig. 65. Unique, Unclassified.
Upper: Shaw rubber-band gun.
Middle: Unmarked single shot.
Lower: Double barrel.
(Neg. 203350)

almost empty. From the standpoint of effectiveness, however, certain forestock-pump air guns can develop greater power, at the expense, however, of muscular fatigue.

Additional unique pieces are illustrated in Fig. 65:

1. John Shaw, an Englishman, received a British patent August 1, 1849 (2, p. 110), on "Certain improvements in air guns." The piston for compressing air for discharge is related to known spring guns, but in this case is powered by a "strong india-rubber spring!" Actually, the Shaw gun was a combination of a gallery gun and a so-called slingshot or catapult. The specimen, considering its limited capabilities, is well made, but, properly advertised, anything new will sell.

2. It is a matter of question whether or not this specimen should have been included with the pump-in-butt classification. It was kept out of that group because of the unique breech, which is reminiscent of the trapdoor Springfield. It is a single shot—all goes each time. The pump, incidentally, has a knurled button for holding and is operated while the muzzle of the arm is down, not up, as in the pump-in-butt group. One stroke of the pump is needed per discharge.

3. Of all the uniques this double gun is probably the most outstanding. It has a cylindrical butt-reservoir, under-hammer, two barrels, and a ramrod. The latter is a stroke of genius, inasmuch as a single discharge is directed through both barrels, whereas only one should be shot. The rammer is equipped with a coiled spring which, during discharge, compresses, and takes up the pressure within the barrel *not* to be discharged—like a cushion. The ramrod, it should be mentioned, is not carried in thimbles, but is screwed into the muzzle of the unused barrel.

Moderns – A Glimpse

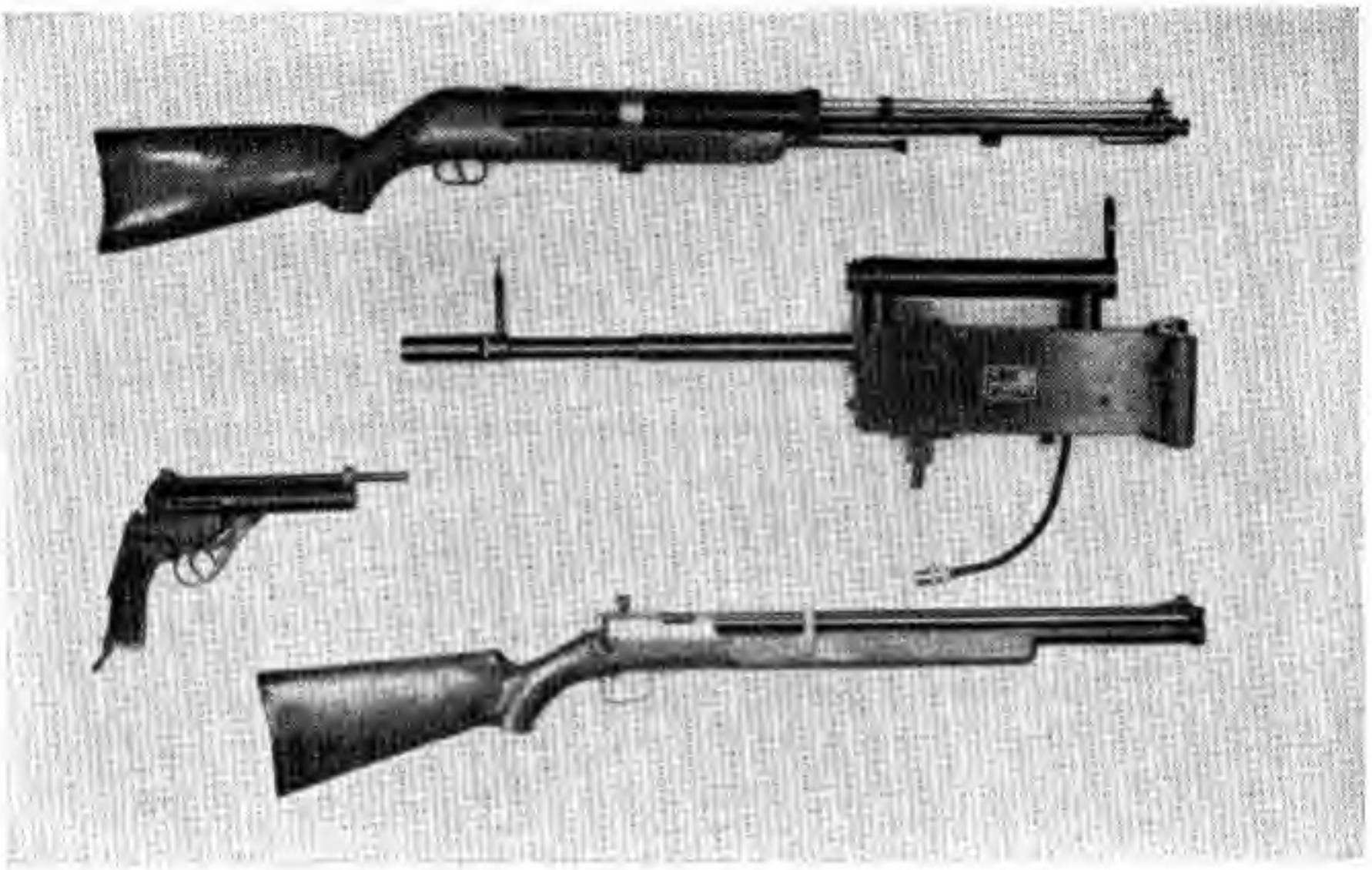

Fig. 66. Modern Air Guns.
1st. Paul shotgun.
2nd. Mac Glashan machine gun.
3rd. Westley Richards "Highest Possible."
4th. Sheridan.
(Neg. 203348)

To bring the air gun story to date would extend the scope of this volume past the point of comfort. Actually, the record from 1900 to the present would fill another book. It would be sad, on the other hand, to ignore that phase of the narrative entirely, so we present four examples, just to show what has been done. It was a gamble, frankly, to determine which were to be shown, and it is sincerely hoped that no makers will feel slighted. Current items are included in the list of makers (Appendix III).

1. The shotgun patented by Wm. Paul (81; 82) of Beecher, Ill. is equipped with a longitudinally-operating pump below the barrel. A folding foot rest is present and the gun has the pressure developed by working up and down, the muzzle being downward during the operation. Shot cartridges originally were made for the gun, to be inserted into the breech when the barrel is moved forward. The arm performs amazingly well in spite of the low pressure used.

2. Even machine guns have been made for air firing. The MacGlashan gun was intended as a training weapon for aerial gunnery. It shoots steel BB shot and rapidly disintegrated the magazines or wood panels which were used as experi-

mental targets. Power is provided by a tank of compressed carbon dioxide and the lock is operated by electric relays.

3. Westley Richards' "Highest Possible" is just the thing for a retired English army colonel who wants the feel of a real, heavy pistol. In spite of its ponderous appearance it is rather inefficient. After releasing a catch which resembles a grip safety, the butt is moved in a downward arc, compressing the spring and plunger forward. After returning the grip to normal shooting position, the pistol is discharged amid odd sounds and an uncomfortable jar. The reaction of the spring and piston leaves much to be desired in the matter of accurate shooting, and the weapon must admittedly be far from "highest possible."

4. The Sheridan is an unusually high-compression air rifle of the forestock-pump variety. In this mechanical feature it is in the same group as the Crosman, Benjamin, Challenger, and Apache. One of the features in the Sheridan is a sealed valve unit which, if worn, can be easily replaced. The manufacturers claim (215) that pressures up to half a ton may be built up in a Sheridan, which indicates the highest recorded pressure for which any air gun has been designed. Differing from the other presently made air rifles in which hollow-base pellets of calibers .177 or .22 are employed, the Sheridan shoots a specially designed "Bantam" 5mm. bullet that has a slightly over-sized band at the base to grip the rifling with a minimum of friction—in effect, a driving ring.

Appendix I

MISCELLANEOUS PRODUCTION RECORDS, H. M. QUACKENBUSH

(From Factory Records)

AIR PISTOLS	1884	1893
Eureka	74	
Champion	69	
	143	
AIR GUNS		
No. 1	1760	286
No. 2	557	111
No. 3	56	30
No. 4	154	25
Lightning	354	
No. 5	38	147
	2919	599

NOTE—Total production of air guns of all types for 1883 given as 2322. No earlier records are available.

SALES, 1923 to 1943. NO MODELS LISTED.

1923.....475	1930.....101	1937..... 26
1924.....406	1931..... 68	1938..... 29
1925.....428	1932..... 24	1939..... 43
1926.....321	1933..... 41	1940..... 40
1927.....263	1934..... 63	1941..... 61
1928.....195	1935..... 76	1942..... 30
1929.....167	1936.....176	1943..... 74

SERIAL NUMBERS ASSIGNED TO QUACKENBUSH AIR GUNS

Data from H. M. Quackenbush, Inc.

No. 1 Quackenbush

September 1, 1909 31,336
October 3, 1915 1-33539
May 6, 1926 1-36553

No. 2 Quackenbush

September 10, 1909 12,317
September 11, 1915 2-14055
February 23, 1916 ..... 2 or 3-14438
January 30, 1922 ..... 2 or 3-16823

No. 5 Quackenbush

1885—February 14 136
1886—February 23 426
1887—February 24 553
1888—March 29 687
1889—January 17 844
1890—January 13 1020
1891—May 20 1187
1892—January 7 1334
1893—March 22 1478
1894—March 27 1659
1895—June 7 1764
1896—March 20 1822
1900—February 5 2289
1907—May 15 3107
1911—May 3 ..... 3185 (Last entry)

PRODUCTION OF AIR GUNS BY MODELS

H. M. Quackenbush, Inc., Herkimer, N. Y.

Year	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	Total
1893	286	111	30	25	147	...	...	...	...	...	599
1894	348	145	30	32	133	...	...	...	...	...	688
1895	357	147	24	17	100	...	...	...	...	...	645
1896	269	101	18	24	114	...	...	...	...	...	526
1897	473	102	36	35	110	...	...	...	...	...	756
1898	442	145	65	22	70	...	...	...	...	...	744
1899	551	181	113	63	158	...	...	...	...	...	1066
1900	1097	259	62	77	164	...	...	...	...	...	1659
1901	769	197	72	61	148	...	...	...	...	...	1247
1902	826	233	62	55	88	...	...	...	...	...	1264
1903	767	291	40	29	38	...	...	...	...	...	1165
1904	636	290	30	27	56	...	...	...	...	...	1039
1905	750	375	28	27	74	...	...	...	...	...	1254
1906	628	358	59	44	76	...	...	...	...	...	1165
1907	738	299	90	..	53	717	...	...	...	...	1897
1908	360	216	76	..	42	286	...	...	...	...	980
1909	535	331	79	..	31	433	...	...	...	...	1439
1910	440	279	84	1	29	427	...	...	...	...	1260
1911	320	266	65	..	26	502	...	...	...	...	1179
1912	457	330	65	..	12	...	837	...	...	...	1701
1913	352	247	51	..	1	...	1371	...	...	...	2022
1914	233	179	39	..	...	...	1588	...	...	...	2039
1915	357	227	63	..	...	...	2013	...	...	...	2660
1916	296	298	63	..	...	...	2466	...	...	...	3123
1917	563	307	90	..	...	...	1144	...	...	...	2104
1918	318	50	9	..	...	...	478	54	...	...	909
1919	481	...	5	..	...	...	1718	80	...	248	2532
1920	383	...	...	..	...	...	1264	4	309	175	2135
1921	177	...	...	..	...	...	239	...	53	102	571
1922	74	...	...	..	...	...	299	...	41	25	439
Total (1893–1922)	14283	5964	1448	539	1570	2365	13417	138	403	550	40677

PRODUCTION OF TARGETS, DARTS, AND SLUGS

H. M. Quackenbush—from factory records

	1884	1893
TARGETS		
No. 1	44	17
No. 2	156	34
No. 3	13	454
	213	505
DARTS		
.175	.....	2609
.210	83905	30204
.215	71500	3372
Other	1890	....
	157295	36185
SLUGS		
Felted	3350800	1122600
Burred	617800	80900
	3968600	1203500

Appendix II

AIR GUN COMMENTS

By Kunitomo Fujihyōe

(Translation from the original text in Japanese by A. J. Gillan, Milwaukee Public Museum, August 17, 1949.)

EDITORIAL COMMENTS

In the preface the author indicates that the gun he received from the Dutchman was inefficient. It is quite possible that the specimen was, at that time, already quite old and in imperfect condition. It appears that the valve was incapable of holding the needed pressure.

The remarks regarding neither gunpowder nor "fire-rope" needed indicates that Kunitomo was familiar with the currently used Japanese matchlock guns only.

In view of the fact that Kunitomo prepared a duplicate of the Dutch weapon, it is reasonable to presume that the improvements he noted referred to the newly made gun.

Subsequent references to "copper fittings" seem to mean brass or bronze.

"Fox" means "hammer" or "cocking piece." The design of the member caused appropriate naming.

The curious reference to the screws is understandable, inasmuch as the then known Japanese matchlocks were held together by a unique pin arrangement. The reference to the screwdriver-wrench is also indicative.

Other Japanese terms and their English equivalents are the following.

Foundation block . . . lock plate

Throw-in metal . . . striker

Air runs through . . . air channel from reservoir to breech

Spring metal . . . main-spring

Trigger press . . . trigger spring

Storage air tube . . . air reservoir

Active air tube . . . valve cylinder

Power-air cane . . . pump piston

Power-air leather . . . leather bushing

Iron step-on . . . foot rest

The shooting position appears to have been new to Kunitomo.

A Japanese shot his weapon by holding the side of the gun butt against the cheek, not the extreme end against the shoulder.

The unnamed part of the pump piston seems to be an addition to the original equipment unless it illustrates a section of the pump cylinder. Nothing similar to the item illustrated has been encountered in European pumps but, no outside lock air gun pumps having come to light with assurance, it cannot be asserted that such an addition was not employed.

It appears that Kunitomo also employed his weapon as a shotgun.

One outstanding omission in this discussion by the Japanese writer is any reference to the valve, which, in our opinion, is the most important element in a reservoir air gun. Kunitomo, being a member of an armorer's craft, which had many trade secrets, may have allowed the omission intentionally.

The very literal original translation of the Japanese text has been slightly altered in arrangement and in instances considerably amplified through the addition of parenthetical insertions (in Italics) which serve as technical terms in the English language and as additions to complete certain thoughts which may otherwise be vague, although quite obvious to a Japanese.

AIR GUN COMMENTS

One Volume

AIR GUN COMMENTS PREFACE.

Dutch name: "Wind ruur." Commonly called "Kazetsutsu."

Although times of peace are precious, the sages command us not to forget that peacefulness is dangerous. Accordingly do not throw away the military arts. People have done everything possible to promote the various inventions and take up especially the art of guns. Some time ago a Dutchman brought to me an air gun with an iron chamber for collecting air inside. This air storage gave the gun enough strength to penetrate a third to a half inch of wood board at a range of nine feet distance in a test with a lead pellet. Of course, gunpowder is not used and a fire-rope is not needed. Truly this could become a very wonderful thing if made so as to eliminate the danger.

Two shots used up all the air and it was accordingly very difficult to fire three shots, and so not made (not practical) for military use. If made merely for little children to play with, it would truly be a dangerous and useless thing. I admired this ingenious mechanical device but it could be used for military purposes only if one worked upon the invention and supplemented it with many parts. At the expense of a thousand trials and ten thousands of errors I pushed an investigation of the principle. Moreover, I consulted with friend Hitoyama Mitsune, who added fresh ideas to the old Dutch product. Now, when put to the test, the lead pellet goes far and fast and unfailingly pierces entirely through hard wood boards as often as five or six times, probably fifty or sixty times as powerful as the Dutch product. In writing this book of comments perhaps the discussion shows very little skill. If it happens to be a success it is only because others have heard of the manufacture of this air gun lately. Every day people ask questions, and to satisfy all of them one would have to be free from occupation. But this not being the case I have answered their requests by giving an amateur picture from every side.

Bunse: era, 2nd. year, spring (*1819*).

Goshu (*Province of Omi*).

Kunitomo Fujihyoe Noto, author (i).

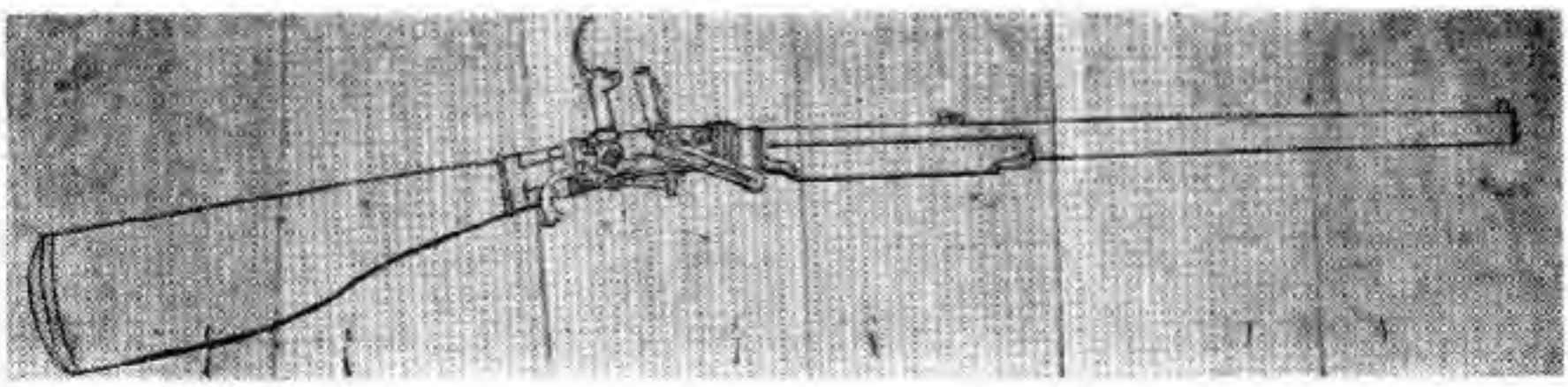

Fig. i

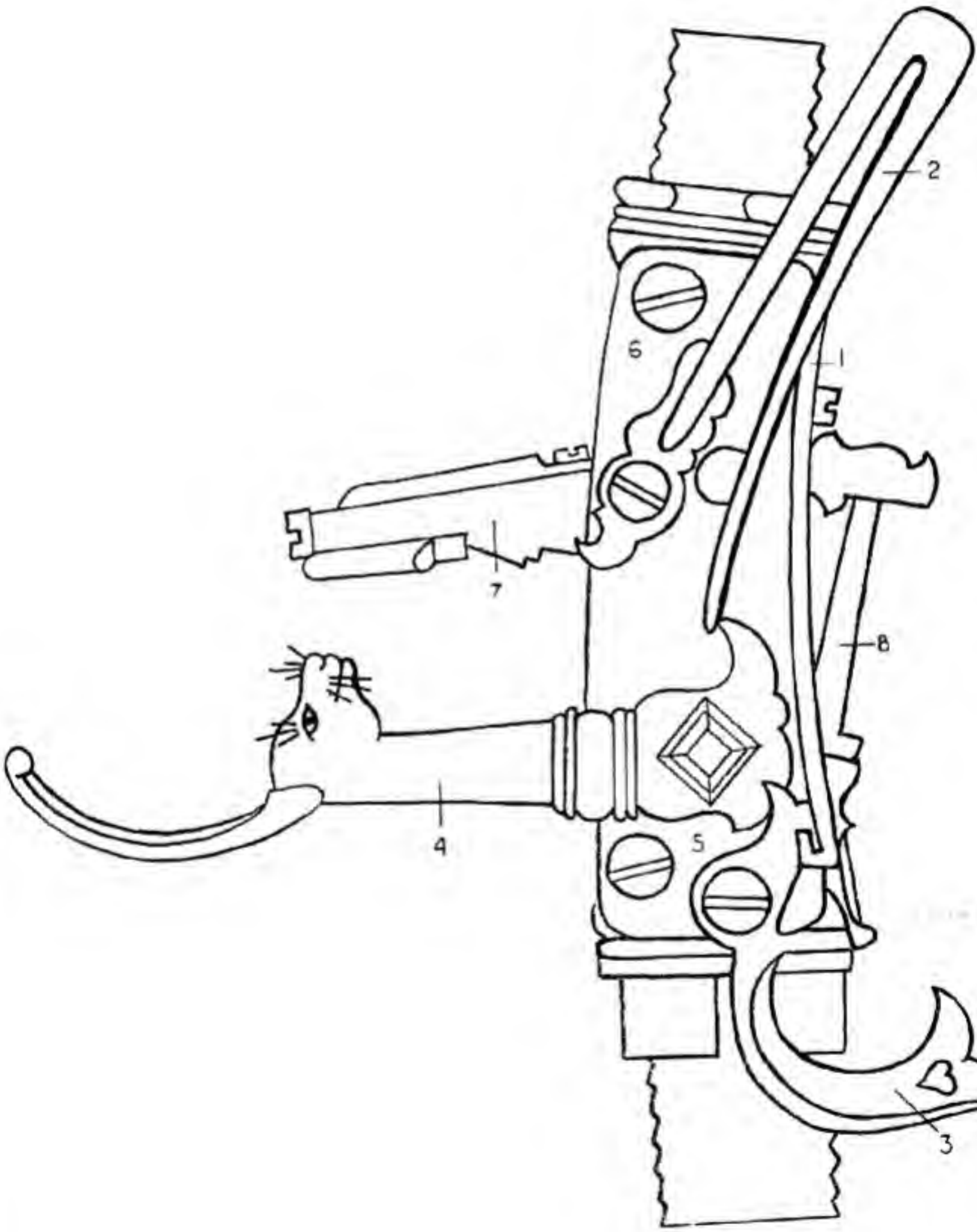

Fig. ii

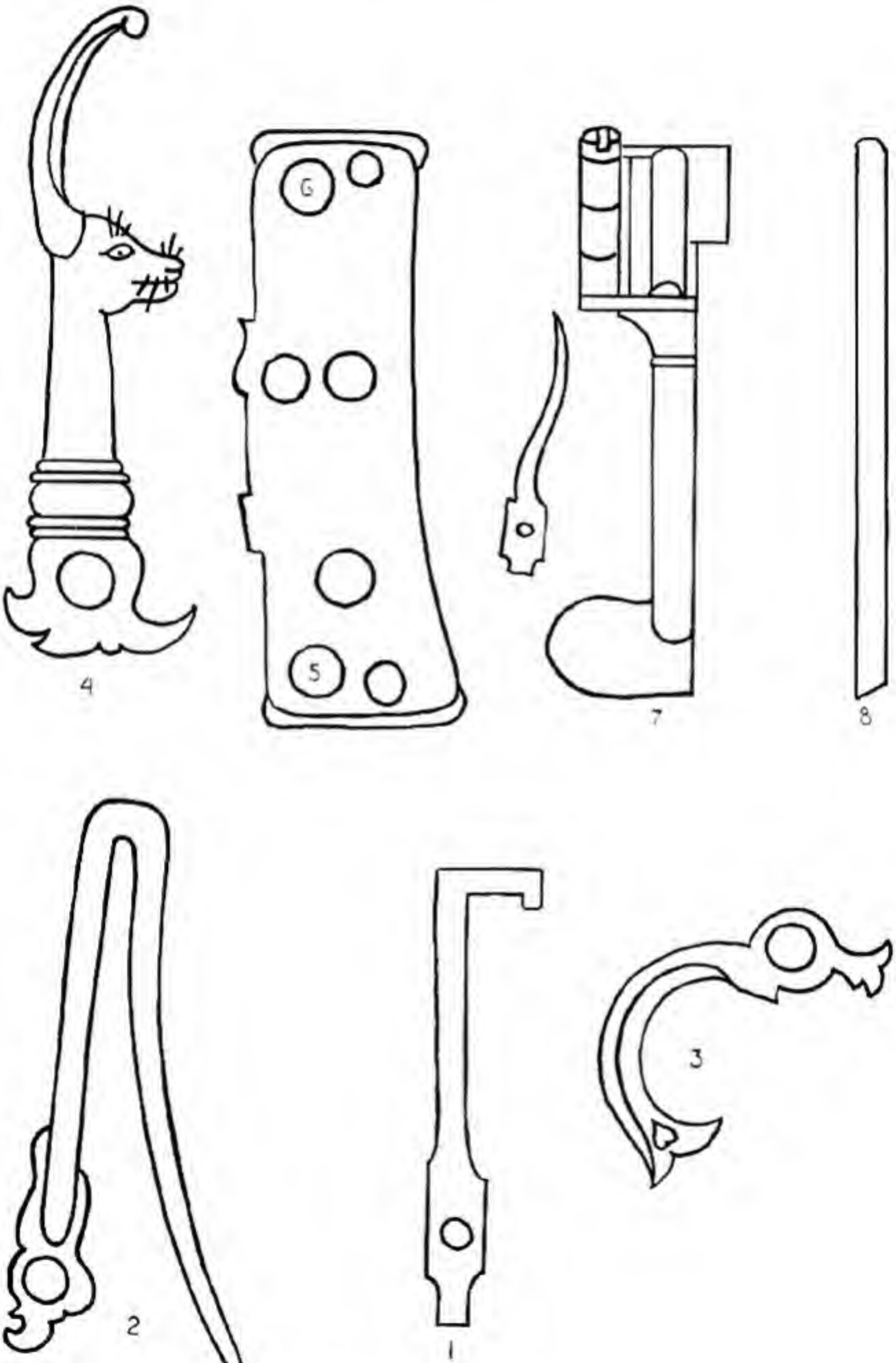

Fig. iii

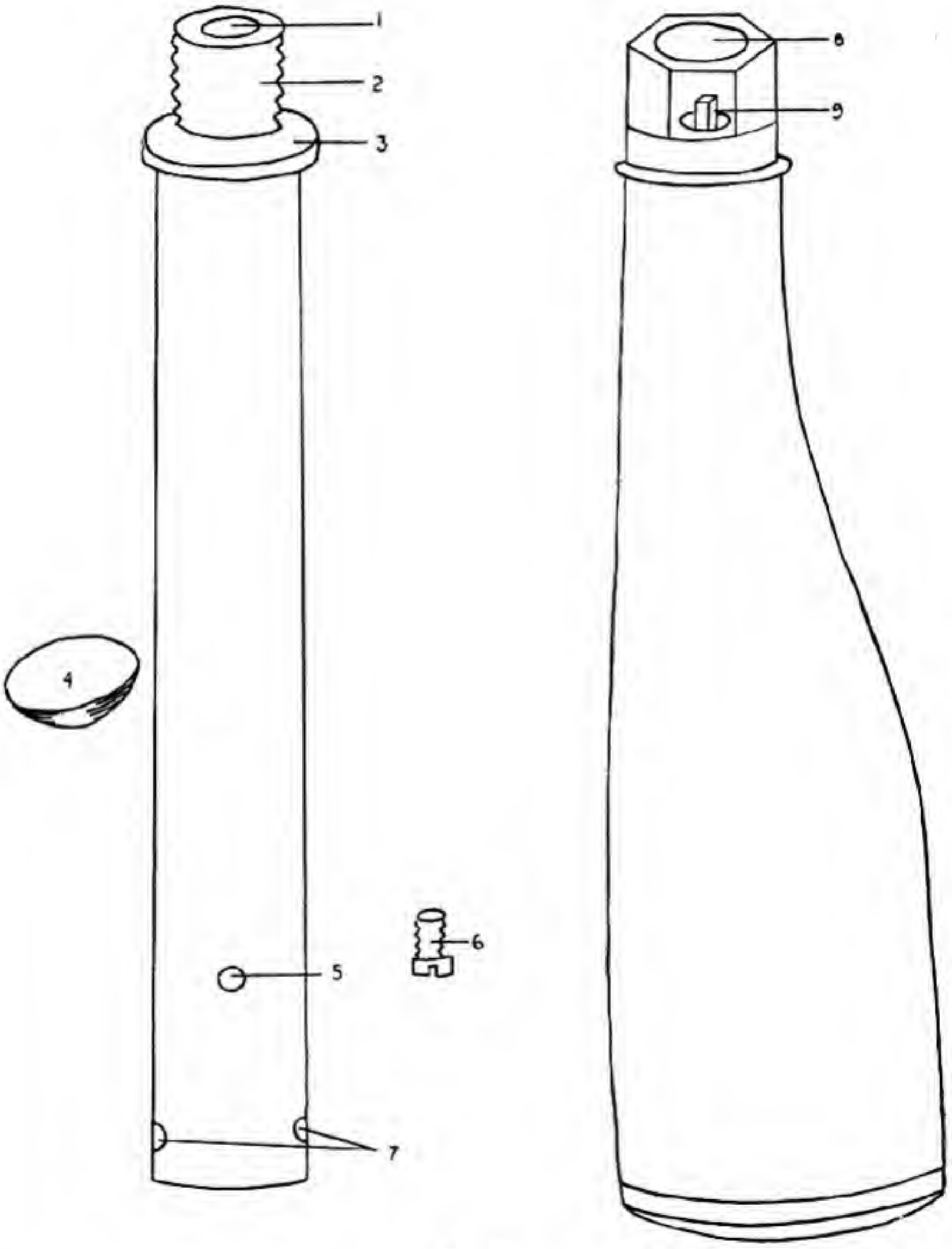

Fig. iv

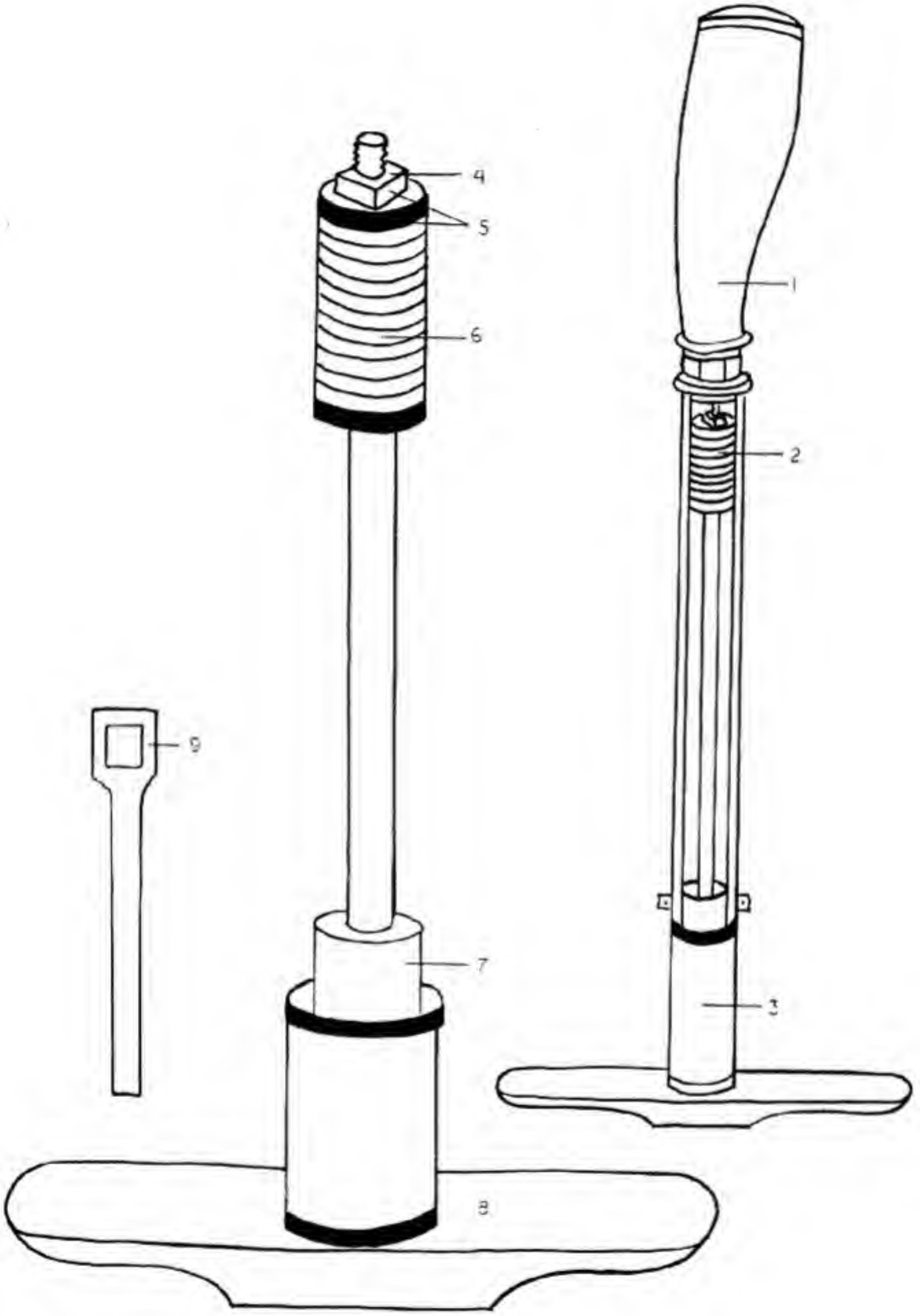

Fig. v

When there is no air the lead pellet, even though properly loaded, will not be propelled even an inch. The barrel will be greatly harmed if the weapon is dropped or improperly hung.

Observe the pictures of the copper fittings (ii, iii). The parts are to be coated with camellia oil at certain points: the screws which join the fox to the block (*hammer to lock plate*), and where the fox (*hammer*) and spring cock (*main-spring*) meet. Screws are made of hard iron. In using the screws, turning them too much or too little is not necessary. Naturally, turning the screw loosens the fittings a little or again tightens them.

The pieces are illustrated. It is essential to follow the picture.

The active air tube (*valve cylinder*) and storage air tube (*reservoir*) are illustrated (iv). One should assemble them in the manner noted in the picture.

One assembles the pump in the following manner (v): the power-air cane (*piston and stem*) is put into its tube. Put the screw into the hole entering the tube, inserting the power-air cane (*piston and stem*) at the inside of an unnamed part (?). At each time of use, before applying camellia oil, first loosen the head of the screw of the valve cylinder.

The pump is made of hard iron. The power-air leather (*of the piston*) consists of a number of flat pieces of leather piled one on another. To correct air leaks a scanty coat of kyarowood oil is painted on the screw. The square screw (*nut*) compresses the leather. Below the square screw is red leather (*the washer?*). The square screw on the power-air cane can be slowly turned. Turning to the right makes it firm and turning to the left makes it loose. When too loose, air leaks; when too firm, it is difficult to move up and down.

One operates the pump in the following manner (vi). Both feet being on the foot rest, with both hands grasp the pump and reservoir assembly firmly and move up and down constantly. Three hundred times is good. If this becomes rather difficult then the efforts of two men are needed. With one person sitting across from another, four hands ought to be able to move it up and down.

For more air power (*through additional weight*), fasten about two feet of cloth (*to the reservoir*) and to the top of the obi. To hold down the feet they can be bound by a cord.

Shooting is done in the usual manner (vii). For shooting, the left hand grasps the metal fittings and the right hand meanwhile pulls the fox, which engages the trigger. To pull the trigger just a little bit the finger of the left hand ought to rest on it during this time (*to aid engagement*). If the missiles be small there ought to be a thousand shots (*i. e. one thousand or very many tiny pellets per discharge; a scatter load, as in a shotgun*).

The barrel, since it is wrapped in leather, is not washed or wiped after shooting; one should simply wipe the metal parts with a manufactured cotton cloth on which is put some camellia oil.

Fig. vi

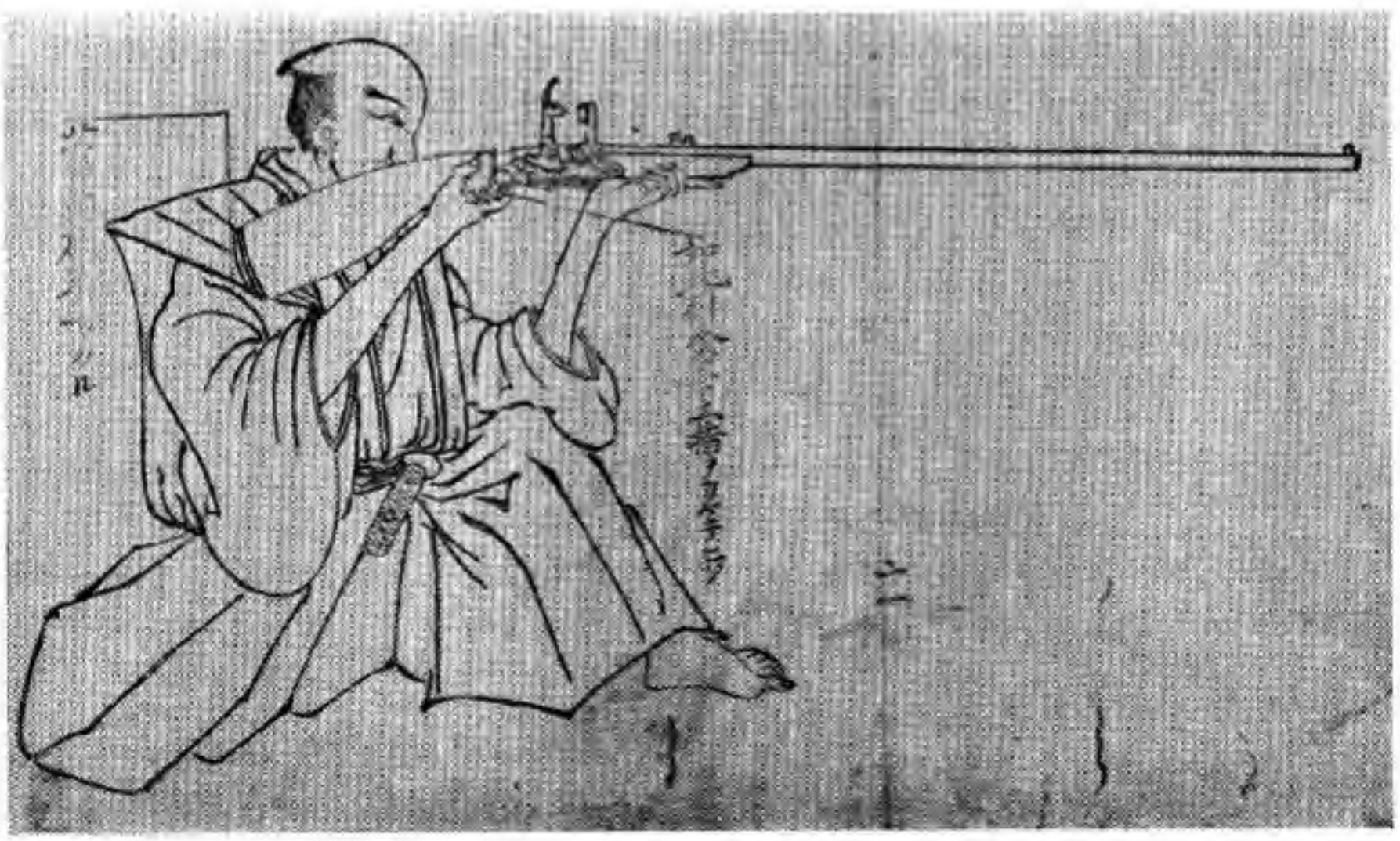

Fig. vii

TITLES

i (*Kunitomo's air gun. The original illustration covers three double pages.*)

ii (*The receiver assembly.*)

iii (*The essential lock parts, without screws.*)

1. Trigger press (*trigger spring*).
2. Spring metal (*main spring*).
3. Trigger.
4. Fox (*hammer*).
5, 6. Foundation block (*lock plate*).
7. Throw-in metal (*striker*). (*This spring is*) pressed by a screw (*maintaining the striker latch*).
8. Air runs through (*air channel*).

iv (*Left, valve cylinder. Right, reservoir.*)

1. This enters into the top of the storage air tube (*reservoir*).
2. Screw.
3. Leather.
4. Clam shell. This much camellia oil is used each time of use.
5. Air goes through this hole.
6. Screw.
7. Holes.
8. The active air tube (*valve cylinder*) is screwed in here.
9. When used three times, camellia oil is poured into this hole.

v (*Left, pump piston assembly. Right, pump and reservoir assembled for use.*)

1. Storage air tube (*reservoir*).
2. Power-air tube (*pump cylinder*).
3. Power-air cane (*piston rod, inside*).
4. Square screw (*nut*).
5. Joined (*nut and washer in contact*).
6. Power-air leather (*washers*).
7. Unnamed part.
8. Iron step-on (*foot rest*).
9. Tool. The end with the square hole is for turning the square screw (*nut*) the other for regular screws.

vi (*Pumping technique.*)

vii (*Shooting position. Kunitomo notes placing the butt end of the reservoir against the shoulder and manipulating the trigger down and outward.*)

Appendix III

MAKERS' LIST

NOTE

Geographic locations and cities are, if possible, noted within the political areas of the time. Germany, as well as Austria, along with their dependent states, are considered in terms of their extent previous to World War I. Locating the many cities in their present countries would be confusing. Retaining the political areas of the past additionally aids in establishing the cultural areas of which the air gun distribution is a facet.

"Acier Air Rifle."

Acier means steel in French. It has occasionally been confused so as to signify a brand. The word is found on a Giffard gas pistol. The "Acier" is identified as a 6.5 mm. smoothbore in an advertisement (241).

Albrecht, Heinrich. Darmstadt, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Allger. Zell, Germany or Austria.

This name appears on a pump-in-butt air gun dated 1865. No published reference to this maker has been found. His location has not been established. See Bischoff and Rieger.

Anschütz. Suhl, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Apache.

This is a current forestock-pump air gun made by the National Cart Co., Pasadena, Cal. It has a liner-insert. The combination calibers are: barrel, .250; liner, .175 (BB).

D'Argens. Stuttgart, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Arnth, David. Mergentheim, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Asahi.

This is a Japanese product similar to the B. S. A. spring gun in shape of stock, but has a break-down barrel for cocking. It is made in cal. .177 only (48).

J. B. (John Blanch or John Blisset?). London, England.

These initials appear on the lock of an air cane which is marked "IMPROVED AIR CANE," "LONDON," on the band of the reservoir. The valve cap has a male thread instead of the expected female. A rifled steel barrel is present. The suggestion of Blanch or Blisset as possible maker is indicative of the lack of information on air canes.

Bailey, Elmer E. Philadelphia, Pa.

The patentee of several "BB" guns (7; 8). See Columbian air gun. The commercial product is listed as "MAGAZINE AIR RIFLE, Bailey's patent" (172).

Ballou, Peter.

A suggested American maker, probably confused with Peter Pelaix or Peloux, c. 1816–1829, Philadelphia. Text references are under "Ballou." A gun, presumably by this maker, was offered for sale around 1925 (253), but no substantiating evidence concerning this maker, by the above spelling, has been found.

Bandle, J. Cincinnati, Ohio.

An American gallery gun maker.

Barnes, Frederick & Co. London, England.

An air cane maker.

Bartholomae, V. Potsdam, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Basler, John.

An American gallery gun maker, possibly associated with Basler & Denk, which see.

Basler & Denk. St. Louis, Mo.

An American gallery gun maker.

Bate, Thomas. London, England.

This is one of the best known English air gun makers, the producer of both long arms and pistols, first the top-ball variety and later the bottom-ball type. Bate products are noted and illustrated in the text.

Baucheron, Pinnet. Paris, France.

A wood-covered, butt-reservoir air gun has been examined. It is finely and heavily engraved. The hammer engages a striker through a slot in the lock plate beneath the hammer. A striker knob on the left plate can be pulled back, disengaging the striker from the hammer, thus effecting a by-pass. The barrel is marked "BAUCHERON A PARIS." The lock plate is marked "Gve PAR L'ANGLOIS" (201).

Baumann. Villingen, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Bayer, John. New York, N. Y.

An American gallery gun maker.

Behr. Wallenstein, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Benjamin Air Rifle Co. St. Louis, Mo.

The makers of the "Benjamin Franklin" air rifles and pistols, forestock-pump, cal. .177 and .22. Older models had straight-line pumps similar to the Giffard air pistol.

Bergh, Jean. Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, pp. 582–3).

Bergsträsser. Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Berry, S. W. Tooderidge, England.

A producer of the conventional late English butt-reservoir type air gun with faucet breech. The location has been determined through correspondence (178).

Besch, W. R. Antwerp, Belgium.

A letter (Wandrus, Harry, 239), quoting "THE COLLECTOR," Sept. 1, 1896, suggests that this may be the maker of an outside-lock gun. The date, according to the article, is 1572.

Birmingham Small Arms Co., Ltd. Birmingham, England.

The makers of very high quality spring guns, cal. .22 and .177, with forestock-lever and faucet breech. The guns appear to be developments of the Lincoln-Jeffries rifle (167).

Bischoff, Ernst. Augsburg, Germany.

A pump-in-butt gun by this maker has been made available (199). It conforms to the type.

Blanch, John & Son. London, England.

This is probably only a dealer, not an air gun maker. The company is dated 1809–1835 (90, p. 331).

Blickensdoerfer, J. St. Louis, Mo.

(Blickensdorper & Schilling; Blickensdorfer & Schilling)

An American gallery gun maker.

Blisset, Isaac. London, England.

Blisset has been identified as a maker of conventional late English air guns with a faucet breech and butt-reservoir (24). The suggested date is 1840.

Blisset, John High Holborn, London, England.

Bewsey (24), who dates this maker c. 1850, writes that his brother bought an example by this maker. The classification is still in doubt, be it ball or butt-reservoir.

George (90, p. 331) lists this maker as c. 1820–1835.

Bonehill, C. G. Birmingham, England.

This is the maker of the Britannia air rifle, cal. .22 and .177. The gun has a break-down barrel. The cocking lever and trigger guard, including the trigger assembly, are in one piece. The spring and piston are in the wrist (167).

Bosler, F. J. Darmstadt, Germany.

(Bosler; Bossler).

This maker produced a transitional, concealed butt-reservoir air gun. He appears to have been gunsmith to Landgraf Ludwig VIII of Hesse (123).

Bouillet, Jean and Nicholas. Paris and St. Etienne, France.

The brothers are identified as among those who developed the air gun. A butt-reservoir pistol is at hand, similar, in some of the reservoir features, to the Austrian type. A ball-reservoir example, also a pistol, has been examined. Both are rather unique.

Bourgeois, Marin le. Lisieux, France.

Bourgeois, Jean le.

Marin le Bourgeois was an engraver and gun maker in Lisieux from c. 1575–1598, and in Paris from 1598 to 1624. Jean le Bourgeois, a brother of Marin, was an air gun and gun maker, died in Lisieux in 1615 (224).

Bouron, P. New Orleans, La.

An example by this maker is dated 1870. It has a straight-line under-barrel pump.

Braithwaite. Birmingham, England.

A maker of ball-reservoir air guns (49).

Brecht, G. V. St. Louis, Mo.

An American gallery gun maker, also listed as "Breght" (36).

Breitenstein, I. St. Louis, Mo.

An American gallery gun maker.

Brenneck. Germany.

Mentioned as a maker, c. 1780–c.1820 (58, p. 582).

Britannia air rifle.

See Bonehill, C. G.

Brown, O. H. Davenport, Iowa.

The maker of the Brown pneumatic pistol, recent, caliber .22. The gun is equipped with a straight-line pump from back forward to the breech, with a cylindrical reservoir above, in line with the barrel. The pump grip protrudes at the rear of the receiver.

Bügelspanner.

This is not a maker, although occasionally so identified. It is the German name for lever. It may, because of the structure, be a trade name. The spring guns so identified are of the trigger lever type.

Bull, J. Redford, England.

The maker of an English air gun with sharkskin-covered butt-reservoir. Gardner (87) lists, "Bull, S. Gunsmith of Redford, 1790–1851."

Bunge, Charles. Geneva, N. Y.

The maker of revolving cylinder American gallery guns.

Bunney. London, England.

A maker of ball-reservoir air guns.

Bussey, George Gibson. Peckham, Surrey, England.

Bussey's British patent describes a spring-piston weapon, similar to Quackenbush in appearance, except that the barrel is in line with the cylinder. The barrel is fixed. Cocking is accomplished by inserting a ramrod into the barrel (40).

Calvis. Spandau, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Cantriner (or **Contriner**), **Joseph, Carl, Johann.** Vienna, Austria.

Gunsmiths who, one or all, produced Austrian butt-reservoir air guns.

Ceska Zbrojovka. Brno, Czechoslovakia.

This is a BB training gun. It simulates a bolt action rifle and has a port on the top of barrel which serves as a magazine. See Strakonice.

Challenge air rifle.

See Thorsen & Cassady.

Challenger Arms Corp. Los Angeles, Calif.

Makers of the PLAINSMAN air rifle, current. This weapon has an action similar to that of the Crosman, with the pump under the barrel. A detachable cylinder-reservoir type is also made.

Champion Air Pistol.

This arm was patented by Iver Johnson and Martin Bye but appears to have been involved in the Quackenbush production. Quackenbush darts and felted slugs are labeled ". . . for the Eureka and Champion Air Pistols and Excelsior Air Rifles." ". . . for H. M. Quackenbush's Excelsior, and Hurricane Air Guns, Eureka, Champion, and Pope's Air Pistols . . ." The Quackenbush records for 1884 show a production of 69 Champion pistols. Whether Quackenbush sold these or merely did the manufacturing is in question (135).

Chapel, A. E. Liverpool, England.

The maker of air cane guns (149).

Chicago Air Rifle.

An early, low-priced BB gun produced by the Markham Air Rifle Co., Plymouth, Mich. It is claimed to have been the forerunner of the "Daisy" (5).

Claus. Halberstadt, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Clough. Bath, England.

The maker of a ball-reservoir air gun, believed to date around 1800 (101). George (90) lists Clough at Bath, 1800–1830.

Cogswell & Harrison. London, England.

Makers of cane air guns (244).

Coirier, B. Paris, France.

The maker of a European variant known as "system Quackenbush." It is claimed to have been made by Oscar Will (165, p. 186), and usually sold under other trade names (104, p. 410). Caliber .177.

Colbe, L. London, England.

The Encyclopaedia Londinensis of 1796 identifies Colbe as an ingenious artist who improved on the common air gun (71). He may be a son or grandson of Kolbe.

Colnot. Vienna, Austria.

An Austrian butt-reservoir air gun maker.

Colt Patent Fire Arms Co. Hartford, Conn.

It was reported in 1890 that the Colt Company had bought the American rights to the Giffard gas gun for one million dollars (218).

Columbian Air Gun.

This is a 1,000 shot BB gun. It was patented by Elmer E. Bailey (8) and improved upon by Bailey and Thomas A. Monk (9), both of Philadelphia. It has a cast iron frame. Three known varieties are marked: "Model '99," "1906," and "1908."

Conway. Manchester, England.

The maker of ball- and butt-reservoir air guns. On the pump accompanying one example is engraved: "800 STROKES TO FILL EACH GLOBE WITH AIR" (129). Both the conventional late British faucet-breech and the rear-acting lock variety are known.

Cook. England.

Aside from being the inventor of a coil-spring air gun lock, Cook also invented a similar device for use with percussion cane guns, this latter in May 30, 1824, pat. no. 4960. The air cane patent is not dated, but bears the number "266." The actions are very similar.

Cook, Edgar P. Granville, Ohio.

"Cook, E. P.—Patented Cook air rifle" (232). U. S. Patent, No. 1,116,675, Oct. 16, 1913 (50).

Coster, Cornelius. Germany.

Mentioned as a maker, c. 1780-c. 1820 (58, p. 582).

Crewfe. Herzberg, Germany.

The maker of a butt-reservoir pistol of the Austrian type with a Girardoni magazine (12).

Crosman Arms Co. Rochester, N. Y.

Makers of current forestock-pump and CO_2 pistols and rifles. The basic patent is that of William A. Mc Lean (169).

Ctesibius (Ctesiphus). Alexandria, Egypt.

An ancient philosopher, c. 120 B.C., who has been credited with inventing a form of air gun (143).

Davidson, Joseph. London, England.

A ball-reservoir air pistol by this maker has been recorded (133).

Da Vinci, Leonardo.

The designer of a wire-wound barrel for an "air gun."

Deane, G. & J. 30 King William St., London, England.

An air gun by this maker has been reported (161). It has a sharkskin-covered, shaped butt-reservoir; faucet breech; case-hardened, colored receiver; short forestock, ramrod, and browned twist barrel, rifled. John Deane is listed as 1850–51, also associated with George Deane at the same time (87).

Denver Air Rifle.

See Monner, R. J.

Diana Air Rifle. Germany.
A current spring gun, calibers .177 and .22

Dick, F. R. Buffalo, N. Y.
An American gallery gun maker.

Dinkel. Halle, Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Dison, S. Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Douson. Europe.
This maker is mentioned, without details, by Feldhaus (78, p. 272).

Dreyfous, S. England.
The patentee (1864) of a blow-type pistol, in which a flexible tube connects the mouth of the shooter with the breech of the weapon (180, p. 147).

Dumbler, Peter. Nuremberg, Germany.
In 1607 the Nuremberg lockmaker Peter Dumbler designed a gun that ". . . discharged without noise and with which one could shoot through a board the thickness of a thumb." The Council forbade him its development ". . . because it was so murderous a weapon; one with which murder could be committed without anyone knowing where the shot originated" (163, p. 1).

Ebert. Sonderhausen, Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Echl (three generations). Berlin, Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Echl, von der. Berlin, Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Eckhard, Leopold. Prague, Bohemia.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Egg, D. London, England.
This name occurs in gold on a ball-reservoir air gun.

Eggers, Samuel. New Bedford, Mass.
An American gallery gun maker.

Ellis, Dr. England.
This man is credited with the development of ball-reservoirs, claimed to be an improvement over the butt variety. This claim, dated 1796, completely disregards ball-reservoir technology on the continent (71).

E. M. G. E. Germany.

This is a recent spring-actuated pistol that is cocked by lifting a lever above the receiver (207). It is marked:

"Zenit
Em-Ge-Zella-Mehlis (Thur.)
Cal. 4.5 m/m (.177R) aez
EMGE"

Engle Spring Gun Co. Hazelton, Pa.

(**Stephen D. Engle.**)

A sack of metal-tipped wooden slugs of about .275 caliber is marked:

"100 Projectiles
— For —
ENGLE'S
SPRING GUN
Patented June 23, '85, and Jan. 19, '86
Engle Spring Gun Co.
Hazleton, Pa."

U. S. Patents (72; 73) refer to what is really a form of crossbow.

Eureka Manufacturing Co. Boston, Mass.

The products of this company, aside from "Bedford's Eureka Air Pistol," include a lathe and scroll saw with attachments. The involvements of the pistol are discussed under the heading "Quackenbush."

Excelsior Air Rifle.

On containers of Quackenbush ammunition the following statements are found:

"1 Doz. No. 21 DARTS manufactured expressly for the Eureka and Champion Air Pistols, and Excelsior Air Rifle. U. S. Pat. Feb. 2, '75. Eng. Pat. Oct. 4, '75."

"100 21-100 FELTED SLUGS for H. M. Quackenbush's Excelsior, and Hurricane Air Guns, Eureka, Champion, and Pope's Air Pistols. Pat. Dec. 18, '83."

The Excelsior model remains unidentified as such.

Fach (Fack). Speyer, Germany.

Demmin (58, p. 556) identifies a "Facka Speyer in Holland." "Fach a (or in) Speyer" identifies this maker as one from Speyer in the Palatinate, west of the Rhine, in NW Baden, Germany, the area which produced a number of air-gunsmiths.

Stockel (224) lists: "Fach (Fack) of Speyer, c. 1760."

Gardner (87) lists: "Speyer, Facka or Speger Gunsmith of Holland, 1750."

Lippincott's Gazetteer (159) gives only one "Speyer (or Speier), a city capital of Rhenish Bavaria on the Rhine, 16½ miles N. E. of Landau."

The author calls attention to historical confusion added to mistake.

Nothing is known regarding this maker's products. See Jach.

Fachter. Liege, Belgium.

This maker is mentioned as an air gun maker, without details by Demmin (174, p. 72). Metschl quotes Demmin.

Fecht, George van der. Berlin, Germany.

Stockel (224) lists this maker as the father of a family of gunsmiths. He was a locksmith and "iron cutter" of Jerusalemstrasse 1B, Berlin. He was born in Hamm in 1675. His full name appears to have been John (Johann) George van der Fecht. In 1710 he became the gunmaker to the crown prince's court. In 1711 he became a citizen of Berlin, where he died in 1740.

Fehr, George. Dresden, Germany.

Stockel (224) identifies this maker as a gunsmith for a ducal regiment in 1652. The record extends to 1659.

Felber. Ravensberg, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

F. G. Nidau, Germany.

Stockel (224) lists a shield with "FG" in script on the barrel of an air gun from Nidau, c. 1770. Sometimes spelled Nydau, this town lies about 16 miles N. W. of Berne.

Fifield & Richardson. 44 Washington St., Boston, Mass.

An advertisement in the Boston Directory (30) of 1863 quotes, "A good assortment of Double & Single Guns, Gun Canes, Air Canes, and Saloon Pistols, of English and French manufacture."

Fischer, I. G. Oederan, Germany.

A bar-lock ball-reservoir gun by this maker has been reported (217).

Fischer, Martin. Suhl, Germany.

Fischer is mentioned as among the early German armorers who developed the air gun (58, pp. 556, 582). Stockel (224) dates this maker c. 1770. Gardner (87) suggests 1760–1769.

Fisher, G. New York, N. Y.

An American gallery gun maker.

Fletcher, Thomas. 42, Poultry ; London, England.

An air cane maker and general dealer as well as gunsmith.

F. L. Z.

A pistol of unknown origin is so marked. The spring piston is cocked by tilting the barrel downward, thus forcing the spanner lever to the rear. Cal. .177 and .22. Probably German (35).

Fremmery. Berlin, Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Freund, Carl. Fürstenau, Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Freund, Christoph Wilhelm. Fürstenau, Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Frey, Joh. Heinrich. Zurich, Switzerland.
A late example of an outside-lock gun by this maker is in the Stich collection (222).

Friedler. Ulm, Germany.
Mentioned as a maker, c. 1780 c. 1820 (58, p. 582).

Friedrich, Carl. Zella St: Blasii.
A crank-type spring gun, with flip-up breech, has been examined.

Fruwirth. Vienna, Austria.
An Austrian butt-reservoir pistol, with a Girardoni breech, by Fruwirth, has been examined.

Futter, Johann Joseph. Dresden, Germany.
Futter is mentioned as among the early German armorers who developed the air gun (58, p. 556). Stockel lists him as in Warsaw, c. 1725–1740; Dresden, c. 1735–1776. (224.)

Gartner, J. Columbus, Ohio.
An American gallery gun maker.

Gasquoine, W. 10 Market Place, Manchester, England.
This name and address are engraved on the barrel of an air pump accompanying a cased air cane by James Kerr & Co.

Gemmer, John P. St. Louis, Mo.
An American gallery gun maker.

Georg, J. Stuttgart, Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Gerlach, S. (G.) Berlin, Germany.
Regarding this maker Feldhaus (79, p. 368) identifies one specimen, 18th century; caliber 8.2 mm.

Maretsch (165) states, "Two Berlin gunsmiths of the eighteenth century, G. Gerlach and F. C. Sars, busied themselves particularly in the development of air guns which at that time found increasing use for hunting. . . ."

Stockel (224) lists S. Gerlach, c. 1720–1740, and also an I. Gerlach of Meerholz, 1790. Demmin (58, p. 580) lists Gerlach, S. as of Meerholz.

Giffard, Paul. Paris, France.

Paul, the younger brother of Henri Giffard, acquired independent fame through his own accomplishments. Henri was a recognized student of ballooning and also among other improvements, perfected the steam injector for steam engines. Paul adapted to his purposes the CO_2 gun, which appears to have been one of Peder Rasmussen's experiments, producing two basic varieties in a number of models. He was also the inventor of the pneumatic telegraph. He lived from 1837 to 1897.

Girardoni, G. C. Vienna, Austria.

The inventor of the Girardoni breech mechanism, which was used by many air gun makers. Stockel (224) dates him c. 1765–c. 1800, at Ampezzo.

Globe.

This is a BB gun in which the hinged stock is forced downward to draw back the spring. The patent for this device was granted to Merritt F. Stanley, Plymouth, Mich., on Jan. 28, 1890, numbered 420, 316 (221).

Goellner. Suhl, Germany.

Feldhaus (79) notes an air gun: "Goellner of Suhl, 1830, caliber 7.5 mm.," in the possession of the Berlin Arsenal.

Stockel (224) lists G. A. Goellner, Suhl, c. 1825 to 1850.

Gorgas, J. C. Ballenstädt, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Gottschalck. Ballenstädt, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Gottsche. Merseburg, Germany.

This maker is mentioned by Demmin (58, p. 556) among the early German armorers who developed the air gun. Gardner (87) dates him as c. 1780.

Grebles, A. Chicago, Ill.

An American gallery gun maker.

Greener, W. W. Birmingham, England.

An air cane and spring-type air rifle maker. Greener (102, p. 774) makes extravagant claims regarding the originality of his products, and disregards the century and more of air gun production in England.

Grenet, Jean. Perleberg, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 582).

Greyer, W. New York, N. Y.

An American gallery gun maker.

Gropp.

Feldhaus (p. 272) quotes this maker as having made improvements or alterations in air guns.

Guericke, Otto Von. Magdeburg, Germany.

Stockel notes a gun by Guericke in which the reservoir and bore were combined in one barrel. This seems to refer to something akin to the Sars gun. Maleyka and Feldhaus (p. 368) suggest ball reservoirs also as Guericke products. This maker, the famous mayor of Magdeburg, lived from 1602 to 1686.

Guter. Nuremberg, Germany.

An early air gun inventor, c. 1430 (58, p. 556). Gardner dates Guter as 1560, as does Bocheim (29, p. 647). Knight (144) dates him 1656. Maretsch (155) suggests the middle of the sixteenth century. All the above agree in the matter of the invention.

Haas, I. Neustadt, Germany.

A butt-reservoir air gun by this maker, the butt covered by sections of wood, has been reported (41). It appears to be an example of a "transitional" type.

Haenel. Germany.

A maker of current .177 and .22 spring pistols and rifles. A number of models has been produced.

Hannah, William W. Hudson, N. Y.

This is the patentee of an "Improvement in Spring-Guns," patent number 127,873, June 11, 1872 (116).

The elongated trigger-guard plate, serving as a cocking lever, rotates downward and ahead on a pivot, actuating a rack and pinion which, in one motion, retracts the piston and opens the breech. The breech is closed by returning the trigger guard lever to rest. The patent illustration shows a gallery type pistol.

Hartwich. Potsdam, Germany.

The maker of an outside-lock gun (142).

Harz. Cranach (Kranach), Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Haswell, R. Upper Ashley St., London, England.

This maker has been identified as the producer of an air pistol on a new principle (28, p. 49). No details.

Hauser. Würzburg, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Haviland & Gunn. Ilion, N. Y.

These makers of spring guns were involved with Quackenbush and are discussed in the latter's chapter.

Hawley, E. H. Kalamazoo, Mich.

Hawley (119) received patent number 90,249, June 1, 1869. The result was manufactured by Snow & Cowe, New Haven, Conn., and sold as the Kalamazoo Air Pistol.

Heber. Carlsbad, Austria.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Heberlein, A. St. Louis, Mo.

An American gallery gun maker.

Heiberger, C. Vienna, Austria.

An Austrian butt-reservoir air gun maker; early variety.

Hill, Thomas. Charlotte, Vermont.

This name occurs on the butt plate and also on an extra top plate above the receiver of a combined air gun and flint-lock. The original butt, actually having been a reservoir, is missing, and a wooden replacement is present, the butt plate of which bears the name: "Hill." The weapon is at present stocked in colonial American style. There is no doubt that the name of Thomas Hill on the specimen is fraudulent.

Hintz, Christian. Prague, Bohemia.

A bellows gun maker.

Hirsch, Christ. Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Hoffman, Joh. Christoffer. Schwerin, Germany.

Stockel (224) identifies this maker and dates him c. 1760–c. 1800.

Hohli, J. Berne, Switzerland.

The maker of a double-barrelled, over-under air gun with a butt-reservoir. The upper barrel is rifled, the lower is smooth (123).

Houghton. England?

This name appears on Nunnemacher specimen N6323, a bar-lock ball-reservoir air gun.

Hrusa, Martin. Vienna, Austria.

The maker of an Austrian butt-reservoir air gun, almost identical to that by A. Wolf (152).

Hubertus. Germany.

This is a current spring pistol. The barrel pushes back to load.

Hurricane Air Gun.

An advertisement which identifies this gun by name is illustrated by the pull-ring type. The advertisement is for the Haviland & Gunn products.

See "Excelsior" air rifle, also the Quackenbush chapter, for additional notes.

Hy-Score Arms Corp. Brooklyn, N. Y.
Makers of current spring pistols.

I. Bang Hoang.
This is the mistaken transliteration of a Russian lettering on an Austrian type butt-reservoir air gun with a Girardoni magazine. The true lettering is, "Ivan in Polin." For the original notes see Bannerman's catalog (11).

Jach. Speyer, Germany.
This is obviously an error. It should be Fach. He is noted as having made a double gun with damascus barrels (58, p. 583).

Jackson, W. London, England.
A blow gun maker.

Jahn (Jann) Joh. Christian. Wernigerode, Germany.
Stockel (224) lists Jahn as an air gun maker, c. 1750.

Jaiedtel, F. Vienna, Austria.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 584). A double gun with damascus barrels is noted.

Johnston, J. H. Pittsburgh, Pa.
A dealer who included (and illustrated) American gallery guns in his catalogs (136; 137).

Jover Son & Bate. London, England.
This name occurs on a ball-reservoir air gun. See Bate.

Jung. Warsaw, Poland.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 584). He is identified as a maker from Germany who was established in Warsaw.

Junker. Grambach, Germany?
Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Kalamazoo Air Pistol.
See Hawley, E. H.

Kalb, G. Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Kappe, H. H. Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Kaufmann. Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Kayser, George. Vienna, Austria.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Kelk.

The maker of presumably a continental ball-reservoir air gun with a Girardoni breech. The breech-slider is not, however, provided with a return spring. The lock is enclosed and resembles a box-lock.

Kemmerer. Thorn, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Kerr, James & Co. London, England.

This maker produced air canes. See also London Armoury Co.

Kessler Air Rifle.

An example at hand is marked: "KESSLER–.22 CAL. PELLET RIFLE—BUFFALO, N. Y."

The Kessler Manufacturing Co., producers of current air rifles, has been located at Silvercreek, N. Y. (6).

The arm appears to attempt copying the Crosman forestock-pump rifle.

Klawitter. Herzberg, Germany.

This name occurs on the lock plate of a gun marked "J. M. Nowotny," which see.

Kleinschmidt. Wisterburg, Germany?

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Klett, J. C. Potsdam, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Klyn, Michael. Montreal, Canada.

"From

Major F. A. Gray, Commanding 1st. Batt. Kings Royal Regt. of New York

To

Major B. Lernoult Adjt. General Headquarters, Quebec

Terre Bonne

26. 2. 1783

Sir:

There is a Corpl. of our Regt. who was sent to Sorrel last March, as the only Gunsmith in our Regt., could this man be sent to the Regt. I should be glad as our Arms wants many repairs which we cannot get done in Montreal, when we want them. We have one CLYN, the Air Gun Maker, but he is always sick, this Corpl's name is Mc KACHY and I am told he's now at Quebec.

I am, Sir etc." (27)

In a list of Officers and Men of 2nd Batt. K. R. R. of N. Y. left in Canada May 5th, 1782 appears the following entry: "MICHAEL KLYN, Armourer, Montreal" (27).

Knopf. Salzthal, Germany?

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Koch, Johan. Cologne, Germany. Stockholm, Sweden.

Koch is listed as a clock maker and locksmith of Cologne until 1664, and of Stockholm from Sept. 2, 1664 to 1679, when he died. On May 10, 1666, he received the privilege to produce air guns (224).

Koes, Barth. Amsterdam, Netherlands.

"The Dutch have claimed the Amsterdam mechanic Barth. Koes, who lived about 1660, as the inventor of the air gun" (78, p. 272).

Kohler, Hans. Kitzingen, Germany.

Stockel (224) dates this maker 1644.

Kolbe. London, England.

A maker of barrel-surrounding-reservoir air guns. Stockel (224) lists him in London, c. 1760–c. 1785; George lists him at the same place, c. 1750 (90, p. 333); Gardner (87) identifies him as an arquebusier of Suhl, 1760.

Krawinsky. Posen, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Krüger. Ratibor, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Kuchenreiter, Johann Andreas II. Regensburg, Germany.

An example by this maker, apparently a bellows gun, was described by Laking (148, p. 100). Stockel (224) lists several Kuchenreiters, apparently as father and sons, all gunsmiths.

Kuchenreuter, Joseph I. Stadt am Hof, Regensburg, Germany.

This maker, born 1712, died 1769, is said to have made wheel lock and air guns (224).

Kugler, A. Kingston, N. Y.

An American gallery gun maker.

Kuhlmann. Breslau, Silesia, Germany.

The maker of a transitional, concealed-butt-reservoir air gun. He is listed by Feldhaus (79, p. 369).

Kunitomo, Fujihyoe. Goshu, Omi, Japan.

The author of a Japanese text on outside-lock guns (See Appendix II), and the maker of the Japanese copy of a gun by Scheiffel, which see.

Kunitomo was a descendant of a family that had been active gunmakers for over three hundred years (141, p. 457).

Kunz. Philadelphia, Pa.

An air cane maker and, possibly, the maker of air guns (232; 237).

Lachermeir, Mich. Munich, Germany.

A bellows gun maker.

Lammerer, J. Cranach (Kranach), Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

La Motte, J. Bte. St. Etienne, France.

The maker of a double-barrelled gun, the left barrel of which was for powder, the right for air. The reservoir was a removable butt (101).

Lancaster, Charles. London, England.

An example with this maker's name in the case has been examined. Stockel lists this individual as London, New Bond Street, #151, c. 1845 to c. 1880 (224).

Lang, E. London, England.

A blow gun maker.

Laute, J. Berlin, Germany.

A specimen by this maker, with crank and forestock-flexing breech, has been reported (75).

Lewis, G. E. Birmingham, England.

An air cane maker.

Lichtenfels. Karlsruhe, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Lieberkuhn.

Feldhaus (78, p. 272) quotes this maker as having made improvements or alterations in air guns.

Liebig. Baltimore, Md.

An American gallery gun maker.

Lincoln-Jeffries Rifle.

This is probably the original B. S. A. It is dated c. 1906. See Birmingham Small Arms Co.

Lindner & Molo. New York, N. Y.

Van Rensselaer lists the above and suggests them as makers of air pistols (232). See Lindner, E.

Lindner, E.

U. S. Patent no. 37,173, issued to Lindner on Dec. 16, 1862, describes and illustrates a gallery pistol which is cocked by the reverse power of a grip-strap lever. This may be the pistol referred to by Van Rennselaer, under Lindner & Molo, which see.

Ling, Wm. London, England.

The maker of a shaped-butt, faucet breech, interchangeable shot or rifled barrel air gun. Ling (229), according to the label in an air gun case, was a foreman to Forsyth & Co. for twenty-two years. Townsley has, in common with so many writers in the past, correctly described but imperfectly interpreted the facts.

Linzel, Edward A. St. Louis, Mo.

An American gallery gun maker.

Lippe, von der. Stettin, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Lippert. Cathen, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Lippert, Georg. Eger, Bohemia.

The maker of a crank-type spring-piston air pistol in which the spanner winds up a chain to draw the piston, and the trigger guard is the pressure spring (251).

Lobnitz, Nicolai Johan. Copenhagen, Denmark.

Stockel (224) identifies this maker as born in Rendsburg on March 8, 1798; he died in Copenhagen on May 13, 1867.

Ericksen (74, p. 6), who acknowledges Stockel's data, states that in 1835 Lobnitz invented an air gun that could discharge eighty lethal shots within one minute, at a range of about eighty yards (100 ells).

Lobsinger, Hans. Nuremberg, Germany.

The inventor of an air gun, 1566.

Lowenz, Joseph. Vienna, Austria.

An Austrian butt-reservoir air gun maker whose products appear with and without the Girardoni-type breech.

Lukens. Philadelphia, Pa.

An American maker who produced an air rifle with butt-reservoir and refined outside-lock, not externally recognizable as such.

Lunsmann, Francis. St. Louis, Mo.

An American gallery gun maker.

Lurch, David. New York, N. Y.

An American gallery gun maker.

Lurch, Joseph. New York, N. Y.

An American gallery gun maker. It appears that he characteristically used a reversed "S" in the spelling of "JOS."

Lutgendorf, Joseph Karl Maximilian von (Baron Regensburg).

Von Lutgendorf is claimed to have invented, in 1804, a military air gun with a bullet magazine alongside that held twenty balls. He was a member of the royal Bavarian privy council and court councilor of Thurn and Taxis. He was born on October 10, 1750, died on August 13, 1829, in Regensburg (148; 224).

Mabson & Labron.

Sam Smith, on August 16, 1950, relayed the incomplete data on a gun by the above. It appears to be an English butt-reservoir gun with interchangeable shot and rifled barrels (217).

Marin (Martin).

See "Bourgeois, Marin le."

Maringer, M. Vienna, Austria.

The piece ascribed to this maker (243, #531) appears to be a bellows gun. A portion of the description states: ". . . as usual the crank is missing . . ." The balance of the description is in character, only the precise use of terms describing the bellows is not evident. The specimen may appear again some day and the questions may be answered.

Marion, Charles.

A maker of European spring guns and pistols of the crank type with tilting barrel. Marked: "CHARLES MARION & CH. SANNER."

Markham Air Rifle Co. Plymouth, Mich.

Makers of the Chicago Air Rifle, c. 1890–1900, which see.

Marter. Cologne, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Marter, Damian. Bonn, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Martin, B. London, England.

The Encyclopaedia Londinensis (71) illustrates a ball-reservoir air gun with dummy flint-lock as a fine product of Martin. The article does not acknowledge the advancement of the art on the continent.

Mathe. Mannheim, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Matthui.

Feldhaus (78) quotes this maker as having made improvements or alterations in air guns.

Mayer.

Feldhaus (78) quotes this maker as having made improvements or alterations in air guns.

Mayer & Grammelspacher. Rastatt, Baden, Germany.

The above were makers of a type of spring gun in which the barrel tilts downward to load and cock (165).

McLean, William A. Rochester, N. Y.

A patentee. See Crosman Arms Co. (169).

Meier. Nordhausen, Germany.

According to Stockel (224), Meier is claimed to have invented an air gun with a strong iron reservoir, on a principle that was previously known.

Midland Gun Co. Birmingham, England.

An air cane maker.

Mills, T. London, England.

Bewsey (23) bought a single-shot muzzle loader by Mills. Gardner (87) dates him 1821–24; Stockel (224) lists a "Milles" of London, c. 1830 and c.1835, with three specimens examined. George (90, p. 333) says: "W. Mills, London, 1810–1820."

Mock, A. New York, N. Y.

An American gallery gun maker.

Mond, Jos.

A bellows gun maker.

Monk, Thomas A. Philadelphia, Pa.

A patentee (9). See Columbian air gun.

Monner, R. J. Denver, Colorado.

The inventor of the Denver Air Rifle, in which carbon dioxide in the form of dry ice is used instead of liquid CO_2. Current.

Moon, A. New York, N. Y.

An American gallery gun maker.

Morse.

A trade card of H. M. Quackenbush, illustrating steel air gun and pistol darts, lists: "17½—100 for Morse Pistol."

Mortimer, Thos. Jackson. London, England.

A specimen by this maker is known. It has a butt-reservoir, faucet breech, rifled barrel with forestock, and shotgun barrel without forestock (1; 104, p. 304A—Back Cover).

Mouchin, I. Rotterdam, Netherlands.

The maker of a transitional air gun.

Mulacz.

This name occurs on a recent bellows gun as "Anton Mulacz" and "Heinrich Mulacz." Mulacz is listed as working with Pirko, making breech loaders (224).

Müller. Bernburg, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Müller. Steinau, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Müller, J. Berne, Switzerland.

An Austrian type butt-reservoir air gun maker.

Müller, Philip. Warsaw, Poland.

Demmin (58, p. 580) lists this maker as among the armorers who developed the air gun. Stockel (224) lists him in Dresden and Warsaw, c. 1725–c. 1760. Gardner (87) agrees.

Munck, C. H. Washington C. H., Ohio.

An American gallery gun maker.

Nagy-Willoughby.

This name is applied to a current air gun with a forestock pump. It was designed (188) to hold, indefinitely, a pressure of 8000 pounds per square inch and to discharge, through interchangeable barrel liners, BB shot, steel balls up to 5/16 inch in diameter, arrows, frog spears, and, with the use of a special cartridge, shot, equalling the pattern of a .410 shotgun at ranges up to 75 feet.

National Cart Corp. Pasadena, California.

The manufacturers of the Apache Air Rifle.

Naumann. Kassel, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Neubecker. Lille, France.

The maker of an outside-lock air gun (77).

Neureuter, Joh. Salzburg, Austria.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584). To this is added that this maker was very famous.

Nordmann. Berlin, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Nowotny, J. M. Leitnieritz, Poland.

An example is known, spring type, tip-up barrel, crank-operated (179). Stockel lists this maker, as above, c. 1840. See Klawitter.

Oberlander, Johann. Nuremberg, Germany.

A crossbow and air gun maker, said to have invented an air and gunpowder gun with double barrels. Born 1640, died 1714 (224).

Oertel. Amsterdam, Holland. (originally of Dresden)

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Oesterleins, Jos. Vienna, Austria.

The maker of an Austrian butt-reservoir air gun with a Girardoni breech. He is reported to have been a weapon maker, c.1815 (224).

Oit, M. Wiesbaden, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Original.

See Will, Oscar.

Original Will.

See Will, Oscar.

Otto. Brandenburg, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 584).

Papin, Dennis.

"Dennis Papin, the inventor of the steam machine, describes an air gun in the 'Philosophical Transactions' in 1686. This and an improved device of his in 1674 is found reproduced by Gerlach and Traumuller in the *'Geschichte der physickalischen Experimentier-Kunst.'*" (78).

Parker, Field & Sons. London, England.

"Parker, Field & Sons, 233 Holburn; Fowling and rifle guns, pistols, air gun, musket, fusil, carbine, etc." (28, p. 224).

Pary, P. F. Aix la Chapelle (now Aachen, Germany).

An outside-lock gun is reported as so marked (250).

Paul, William. Beecher, Ill.

The maker of a .410 air shotgun, recent. A straight-line pump under the barrel is held by the feet while the gun is moved up and down. It is a breech loader with remarkable power.

Peloux (Pelaix), Peter.

See Ballou.

Pfaff. Cassel, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Pfaff. Posen, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Pirko, Carl. Vienna, Austria.

The maker of Austrian butt-reservoir air guns (206). Stockel (224) lists Pirko as c. 1850–c. 1867. He also lists Mulacz as working with Pirko, making breech loaders.

Pistor. Schmalkalden, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Plainsman.

A current air gun made by the Challenger Arms Corp., which see.

Polz. Karlsbad, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Pope Bros. Boston, Mass.

This company was involved in the ventures that resulted ultimately in Quackenbush products. For details see the chapter on Quackenbush.

Porter, T. London, England.

This is the maker of a questionable air gun. It is described in two sources.

"127. AIR GUN. Length 36 inches. Half octagon bronze barrel about calibre .30, smooth bore, marked 'T. Porter, London.' Air reservoir underneath the forestock, into which the air is pumped, and is discharged by an outside dummy hammer. The air chamber is copper . . ." (238).

"ANTIQUE FLINTLOCK AIR GUN with hollow copper cylinder for holding air, brass band engraved 'T. Porter, London' period 1790, 20½-inch barrel . . ." (13).

The reservoir may be of the ball variety, although the second reference calls it a cylinder.

Potsdam Magazine. Potsdam, Germany.

A seven-barrelled "goose gun" with this mark has been examined. In the past, the mark has been mis-read as "Poizl,—i Ammagau," even by Stockel! Schön (209, Taf. 19, Fig. 65) shows the same mark, as does Thierbach (228, Blatt 9, Fig. 198).

Pötzi, A. Karlsbad, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Powell, P. & Son. Cincinnati, Ohio.

Probably the dealer only of American gallery guns.

Prague. Czechoslovakia.

See Ceska Zbrojovka.

Presselmeyer. Vienna, Austria.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Prosser, Noel.

While Gardner (87) lists: "Presser, London, 1770–1800," Dexter goes into more detail (65). He quotes an unnumbered issue of the "Artillerie de Musee Bulletin," c. 1926, thus:

"The Bulletin gives these conversions as Austrian, and done under Noel Prosser 'Improvement.'"

"Besides the gunsmiths you mention (Ed. note, Hintz, Spatzirer), there were some three (known) in England and 5 (known) in France who converted to air guns, using any kind of gun brought in . . ." etc.

(Who, if anybody, was Noel Prosser, the "converter" of any gun to an air gun? Who could do it, and how?)

Pulverman, Martin & Co. London, England.

Marks (167) illustrates and describes in part the Militia Club air gun. It is a spring gun with breakdown barrel. Pulverman & Co. are noted as agents for this arm, claiming that it was the first air gun used in air gun clubs.

Quackenbush, Henry Marcus. Herkimer, N. Y.

The maker of American spring guns. See the Quackenbush chapter.

Quackenbush, Paul. Herkimer, N. Y.

The inventor of the No. 7 Quackenbush air gun. He is the eldest son of H. M. Quackenbush.

Quade. Vienna, Austria.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

R. A.

An air cane examined is marked: "R.A. Improved 2057."

Randall, Myron. Waupaca, Wis.

Randall, 1895–1944, is claimed to have made muzzle-loading rifles and an air gun. No details (103, p. 4).

Raquet, C. Cincinnati, Ohio.

A maker of American gallery guns.

Rasch. Brunswick, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Rasch, M. H.

This name occurs on an outside-lock gun, engraved on the top of the iron receiver (1).

Rasmussen, Peder. Langeland, Denmark.
A gun maker who experimented early with carbon dioxide air guns.

Raub, Wm. New York, N. Y.
An American gallery gun maker.

Rechold, J. Andreas. Dolp, Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Reck, Georg. Germany.
Mentioned as a maker, c. 1782–c. 1796 (58, p. 583).

Reichert, Manfried. Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Reilly, Edward M. London, England.
An air cane maker and the author of a booklet on the subject (200). His address was 502 New Oxford St. Stockel (224) dates him c. 1865–c. 1880, adding that in c. 1880 this maker signed himself "E. M. Reilly & Co." Gardner (87) dates him 1850–1898.

Reme, David. Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Remington Arms Co., Inc. Ilion, N. Y.
The makers of the Remington air rifle, a recent BB gun.

Rener, C. Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Reser, I. Wolfsberg, Germany?
"Rare Austrian Wind Rifle (about 1800). Bore .22 cal. Set triggers, peep rear, Tyrolean Schuetzen stock. Elaborately engraved all over" (150).

Revol, J. B. New Orleans, La.
Van Rensselaer (232, p. 181) illustrates an air gun very similar in appearance to that by Bouron, made by Revol. The period of production is reported to be around 1870. The information given includes the following. Revol, J. R., New Orleans, La., 1850–1890, made a variety of arms with the following variety of marks: "Revol and Fils 15 Janvier 1854-N. Orleans;" "J. Revol-N. Orleans;" "Revol-N. Orleans." He was known as a saloon percussion rifle maker. There is a serious question about a possible error involving Revol instead of Bouron as the air gun maker. The latter is unquestionably a recognized maker, an example having been examined.

Richards, Westley. London, England.

The maker of a spring type pistol, recent. It is marked:

"WESTLEY RICHARDS
HIGHEST POSSIBLE
AIR PISTOL.
WESTLEY RICHARDS & COy
LONDON. W.
PATENT 24837
1907."

Richter, G. Breslau, Germany.

The maker of a spring gun, side-lever type, with a flexing forestock (217).

Rieger. Munich, Germany.

The maker of a pump-in-butt air gun, the reservoir of which is in the wrist. See Allger and Bischoff.

Rischer, Joh. Spandau, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Robert, Prince of Pfalz.

The credit claimed for this supposed inventor of an air gun is disclaimed by Feldhaus (78).

Roscher, J. Karlsbad, Austria.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Rutte.

Feldhaus (79) says: "The seven other air guns of this zeughaus originate from Rutte in Bohm.—Lieppa, 1830, caliber 10 mm." An example of a gallery gun by this maker has been examined; crank type with flip-up breech.

Sanner, Ch.

See Marion, Charles.

Saps (Sars). Berlin, Germany.

The maker of barrel-surrounding-reservoir and ball-reservoir air guns. The name is generally given as "SARS," but an examined example is marked "SAPS."

Säter, Peter. Lemgo, Lippe-Detmold, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Schaetter, A. Rostock, Germany.

The maker of an outside-lock gun.

Schackau. Baumberg, Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Schamal, F. Prague, Bohemia.
The 1851 Exhibition, London, included an air pistol by Schamal (28, p. 53, item 118).

Schaz, Joha. Burghav. (Austria?)
"Burghav." may be Burghausen, a town about thirty miles north of Salzburg. The name "Schaz" occurs on the cheek of a bellows gun, the barrel of which is marked "Fran. Zelner in Salzb."

Schedel. Stuttgart, Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Scheiffel. Grave, Netherlands.
An outside-lock gun is so marked. This piece is the original from which data were taken for the Japanese report; Appendix II. See Kunitomo.

Schembor, Jos. Vienna, Austria.
The maker of Austrian butt-reservoir air guns with tip-up breech.

Schenk, C. Berne, Switzerland.
The maker of a late variety of outside-lock gun.

Schilling, Frederick. St. Louis, Mo.
An American gallery gun maker.

Schmaltztern. New York, N. Y.
An American gallery gun maker.

Schmalzlar. New York, N. Y.
An American gallery gun maker.

Schmeisser, Hugo. Suhl, Germany.
The maker of Schmeisser air rifles, military style, bolt-action BB guns, recent.

Schreiber. Halle, Germany.
Schreiber is mentioned by Demmin as among the early German armorers who developed the air gun (58, p. 556). Gardner (87) dates him 1760–69.

Schirrmann. Pasewalck, Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Schramm. Celle, Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Schulze, Fr. Breslau, Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Shaw, John. England.

The grantee of an English patent, dated August 1, 1849, for an air gun that uses a rubber band instead of a spring to activate a plunger.

Sheridan Products, Inc. Racine, Wis.

The producers of the Sheridan air rifle, a high quality product with forestock pump, .20 caliber, current.

Sherrer. Bundt (Place?).

"367—AIR OR SPRING GUN, bronze barrel marked 'Sherrer in Bundt.' Total length 20 inches" (173). This appears to be something on the order of a gallery gun.

Shue Air Rifle Co. Milwaukee, Wis.

The makers of recent spring BB guns, break-butt cocking, with Girardoni-type loading device, vertical. Patent no. 1,102,204, June 30, 1914 (216).

Siebert, Anton. Carlsbad, Germany.

Wesley (246) states that he had a crank-operated smoothbore .250 air gun with set triggers (one cocks) by Siebert. Stockel (224) lists this maker c. 1850.

Siegling, Valentin. Frankfurt A. M., Germany.

This maker is mentioned by Demmin (58, p. 556) as among the German armorers who developed the air gun. Gardner (87) dates him 1760; Stockel, (224) c. 1740. Boeheim (29, p. 652) identifies him as a gunmaker, 18th century.

Smith, George. New York, N. Y.

An American gallery gun maker.

Snow & Cowe. New Haven, Conn.

The manufacturers of the Kalamazoo Air Pistol. See E. H. Hawley.

Spaldeck. Vienna, Austria.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Spatzirer, Wenzel. Vienna, Austria.

A bellows gun maker, one example dated 1791. Gardner (87) dates him 1660! Stockel (224) identifies him without date and gives the alternate spelling: Spazirer.

Stack. Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Stanley, Merritt F. Plymouth, Mich.

A patentee. See Globe.

Starck. Vienna, Austria.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Staudenmayer, S. H. London, England.

The maker of Austrian butt-reservoir air guns and improvements. Stockel (224) dates him c. 1810; George (90, p. 334 a, b), 1810–1820; Blanch, (28, p. vii) 1812, spelling the name: Standenmayer.

Stein, W. Camden, N. J.

An American gallery gun maker.

Steiner, G.

This name appears on an American gallery pistol by Wirsing & Schemann, Cincinnati, Ohio.

Stephen. London, England.

Demmin (58, p. 598) identifies this maker as ". . . an armourer of the end of the eighteenth century, whose name is on a wheel-lock gun, as well as on an air gun, preserved in the Museum of Artillery, Paris." Stockel (224) lists him as Stephean, and dates him c. 1800.

Stirda. Vienna, Austria.

The maker of a "primitive" variety of Austrian butt-reservoir air gun (214).

St. Louis Air Rifle Co. St. Louis, Mo.

This name appears on an early example of small-bore American pump-up air gun.

Stoeger. New York, N. Y.

The importer of current foreign arms, including varieties of air guns.

Strakonice Air Gun. Strakonice, Czechoslovakia.

A current spring gun, similar to the Diana and Tell, with breakdown barrel cocking, cal. .177, is marked:

"CESKA ZBROJOVKA
NARODNI PODNIK
STRAKONICE"

See Ceska Zbrojovka.

Syllaba, T. Schlan, Czechoslovakia.

An example is known of the crank type gallery gun with a cover on the crank hole. It has a tip-up breech with flexing forestock and double set triggers. It is smooth bore. The barrel is marked: "T: Syllaba in Schlan" (161).

Syms, J. G. New York, N. Y.

An American gallery gun maker.

T & L. New York, N. Y.

A spring gun with dropping-barrel cocking device, cal. .22, is so marked. It may be Tipping & Lawden (232).

Tanner. Cöthen, Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Targ-Aire Pistol Co. Chicago, Ill.
The makers of current spring pistols.

Tell. Zella-Mehlis, Germany.
The maker of current spring guns.

Thorsen & Cassady. Chicago, Ill.
The agents for the Challenge air rifle.

Tipping & Lawden. Birmingham, England.
"Tipping & Lawden, Birmingham; illustration of gun barrel manufacture, rifles, guns, pistols, air guns, &c." (28, p. 49, item 247). See T. & L.

Töll. Suhl, Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Tonks, J. Boston, Mass.
An American gallery gun maker.

Townsend, J. Birmingham, England.
An air cane maker.

Uebel, Chris.
A possible maker of American gallery guns.

Ulrich. Eberndorf, Germany?
Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Utting. London, England.
The maker of a ball-reservoir air gun.

Vett, J. Jos. Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Voigt, Christian. Altenburg, Germany.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Volkman, Pet. Vienna, Austria.
A bellows gun maker.

Vrel. Coblenz, Germany.
This maker is mentioned by Demmin (58, p. 580) as among the German armorers who developed the air gun. Gardner (87) reiterates the above. Stockel suggests a date of 18th century (224).

Waas. Bamberg, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Wallis. England.

An air gun lock with flint-lock units has been examined. Stockel (224) lists a Wallis in England, c. 1770 and c. 1790; also a Wallis, G. in Hall, England, c. 1820.

Walster. Saarbrücken, Germany.

Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Warrior Pistol.

A current British spring pistol. It has a side lever for cocking.

Weber, Paul.

A questionable maker by this name has been mentioned by Fabricius in 1752 (78).

Webley & Scott Ltd. Birmingham, England.

The makers of current spring pistols and rifles.

Weisbrod, G. I. Nuremberg, Germany.

The maker of a spring gun, crank type, with the piston in the wrist. It has a flexing forestock and appears to be based upon the bellows gun in some of its components.

Wentzlav. Ehrenbreitstein, Germany.

The maker of a transitional-type air gun, with the reservoir in the butt, wheel lock.

Werner, C. Rochester, N. Y.

An American gallery gun maker.

Werner, C. G. Leipsic, Germany.

Demmin (58, p. 556) refers to Werner as one of the early developers of the air gun. Stockel (224) dates him c. 1750–c. 1780. An example has been described (231, p. 103) as a ball-reservoir gun.

Wertschgen, M. Willingen, Germany?

Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

Whitton Daw & Co. London, England.

Wesley (248) describes an example by this maker, having a rifled barrel and a shot barrel, a butt-reservoir, pump, and all other accessories, cased.

Wilkinson, P. London, England.

The maker of a ball-reservoir air gun.

Will, Oscar. Zella-Mehlis, Germany.
A maker of current spring guns. As a precaution against competition, the arms were marked "Orig. Will" in script. Some competitor marked his copies "Original." Unmarked items are also known, all practically identical.

Wilson, John & Co. Liverpool, England.
An air cane maker.

Wirsing & Schemann. Cincinnati, Ohio.
An American gallery gun maker.

Wistaller, F. X. Munich, Germany.
A bellows gun maker (199).

Wolf, A.
The maker of a flip-up breech, Austrian butt, air shotgun.

Zelner, Fran. Salzburg, Austria.
The bellows gun bearing the name "Joha. Schaz," which see, has the barrel marked: "Fran. Zelner in Salzb."

Zimmer, Phillipp. Mainz, Germany.
The maker of an Austrian butt-reservoir air pistol (34).

Zuendorff, John. New York, N. Y.
An American gallery gun maker.

Zürich. Vienna, Austria.
Mentioned as a maker, c. 1780–c. 1820 (58, p. 583).

References

Translation credits.

A.J.G.; A. J. Gillan, Milwaukee Public Museum.
E.G.W.; Eldon G. Wolff, Milwaukee Public Museum.
G.C.H.; G. Charter Harrison, Jr., Madison, Wis.
H.L.W.; Helma L. Wolff, Milwaukee Public Museum.
H.P.; Harold Peterson, Arlington, Va.

1. Abels, Robert. New York. Personal communication, 1950 (?).
2. Abridgements of the Specifications Relating to Fire-Arms and Other Weapons, Ammunition, and Accoutrements. P. 93. London, 1859.
3. American Art Galleries, Catalog, Nov. 12, 1919. New York.
4. American Cyclopedia, The, A Popular Dictionary of General Knowledge. 1873, Vol. 1, p. 218. New York.
5. American Rifleman. Sept., 1946, p. 43.
6. Argosy Magazine. May, 1949, Men's Mart.
7. Bailey, Elmer E. U. S. Patent, Nov. 29, 1892, No. 487169.
8. ..... U. S. Patent, Oct. 24, 1893, No. 507470.
9. Bailey, Elmer E. and Mouk, Thomas A. U. S. Patent, May 3, 1898, No. 603549.
10. Bannerman, Francis, Sons. Catalog of Military Goods, etc., 1925. P. 18. New York.
11. ..... As above, p. 46.
12. ..... As above, p. 97.
13. ..... As above, p. 34.
14. Becker, Bob. Blowing Up Your Game. Field and Stream, March, 1929, p. 34.
15. Beckmann, John. A History of Inventions, Discoveries, and Origins, 4th ed. Vol. 1 (trans. by William Johnston). London. 1872.
16. Bedford, Augustus. U. S. Patent, Jan. 18, 1876, No. 172376.
17. Bewsey, L. C. (London, England). Compressed Air Rifles. Muzzle Blasts, Aug., 1942.
18. ..... Gun Collector, p. 26.
19. ..... Personal communication, April 18, 1945.
20. ..... Personal communication, Sept. 23, 1945.
21. ..... Personal communication, May 28, 1946.
22. ..... Personal communication, June 7, 1946.
23. ..... Personal communication, Dec. 9, 1946.
24. ..... Personal communication, May 7, 1947.
25. ..... Personal communication, July 10, 1949.
26. *Biographie Universelle, Ancienne et Moderne* (trans. H.L.W.). *Tome Vingt Septieme.* Paris (?). 1820.
27. Blackmore, Howard L. Caterham, Surrey, England. Personal communication, quoting "Miscellaneous American Papers, Public Record Office, W. O. 28/5."

28. Blanch, H. S. A Century of Guns. London. 1909.
29. Boeheim, Wendelin. *Handbuch der Waffenkunde.* (Trans. E.G.W.) Leipzig. 1890.
30. Boston City Directory, 1853.
31. Brand, Herbert. Catalog. Cincinnati, Ohio. 1946.
32. Britten, F. J. Old Clocks and Watches & Their Makers. 5th ed., p. 704. London. 1922.
33. *Brockhaus' Konversations-Lexicon,* 14th ed. Topics: *Windbüchse,* Schmettau, Giffard (trans. E.G.W.). Leipzig, Berlin, and Vienna. 1895.
34. Brown, Major R. London, England. Personal communication, Feb. 27, 1948.
35. Brown, Stanley J. Dayton, Ohio. Personal communication, 1948 (?).
36. Brullesauer, George. Sales list, Nov. 10, 1939. St. Louis, Mo.
37. Budge, Sir E. A. Wallis. The Mummy. Cambridge University Press. 1925.
38. Bunge, Charles. U. S. Patent, Aug. 31, 1869, No. 94279.
39. Busch, Wilhelm. *Familien-Album.* P. 197 (trans. E.G.W.). Munich, 1909.
40. Bussey, George Gibson. British Patent, Feb. 9, 1876, No. 526.
41. Buttin, Charles. *Catalogue de la Collection D'Armes Anciennes Europeennes et Orientales de—.* Item 411 (trans. H.P.). Rumilly. 1933.
42. Cellini, Benvenuto. The Autobiography of, (trans. by John Addington Symonds). The Modern Library, Random House, New York. (No date.)
43. Cheney, Dr. Prentiss D. Current collection. Jerseyville, Ill.
44. *Chronicon Nurembergense.* Schedel (Hartman), 1493, p. 160.
45. Clephan, Robert Coltman. An Outline of the History and Development of Hand Firearms, from the Earliest Period to about the End of the Fifteenth Century. London. 1906.
46. Cohn's New Orleans Directory, 1853.
47. Cole, Fay-Cooper. The Tinguian. Field Museum of Natural History, Anthropology Series 14:2. Chicago. 1929.
48. Cole, F. R. Madison, Wis. Personal communication, 1950 (?).
49. Collins, J. F. Rochester, N. Y. Personal communication, 1948 (?).
50. Cook, Edgar P. U. S. Patent, Oct. 16, 1913, No. 1116675.
51. Craig, Dorothy L. Assistant Librarian, Geneva Free Library, Geneva, N. Y. Personal communication, 1949 (?).
52. Cummings, Lewis V. I Was a Head-hunter. Houghton Mifflin Co., Boston; The Riverside Press, Cambridge. 1941.
53. Daly, Charles Noe. Collection. Howard Studios, Toronto, Canada. 1933.
54. Daniels, Jonathan. North Carolina. Holiday, 2:10, p. 50.
55. DaVinci, Leonardo. The Notebooks of. Edward MacCurty. Garden City Publishing Co., New York. 1941–2.
56. Dean, Herman P. Collection. Huntington, West Virginia.
57. Deane's Manual of the History and Science of Fire-arms. P. 57. London. 1858.

58. Demmin, Auguste. *Die Kriegswaffen.* Pp. 556–558 (trans. E.G.W.). Leipzig. 1869. English edition: Arms and Armour. Pp. 537–539. London. 1877.
59. Dexter, F. Theodore. Topeka, Kansas. Sales list, March 7, 1935.
60. ..... Sales list, Sept. 11, 1935.
61. ..... Sales list, Nov. 8, 1935.
62. ..... Sales list, July 21, 1936.
63. ..... Sales list, Nov., 1945.
64. ..... Sales list, May, 1946.
65. ..... Personal communication, July 27, 1944.
66. *Dictionnaire Universel des Sciences, des Lettres, et des Arts* (M. N. Bouillet), 3rd ed., p. 718 (trans. H.L.W.). Paris. 1857.
67. Dürer, Albrecht, The Complete Woodcuts of (ed. by Dr. Willi Kurth). Crown Publishers, New York. 1946.
68. Edwood's St. Louis City Directory. (Dates as noted in text.)
69. Elliot, W. H. U. S. Patents, May 16, 1865, No. 47707; Oct. 3, 1865, No. 50232.
70. Encyclopaedia Britannica. 14th ed., 1929. Topic: Liquification of Gases.
71. Encyclopaedia Londinensis, 1796. P. 221.
72. Engle, Stephen D. U. S. Patent, June 23, 1885, No. 320643.
73. ..... U. S. Patent, Jan. 19, 1886, No. 334575.
74. Eriksen, Egon. *Dänische Orgelspingolen mit Einheitspatronen, 1850–1877.* (Trans. E.G.W.) Copenhagen. 1945.
75. Ernst, Robert. Port Clinton, Ohio. Personal communication, 1953 (?).
76. Evans, Ivor H. N. Among Primitive Peoples in Borneo. Lippincott, Philadelphia. 1922.
77. Far West Hobby Shop. Catalog No. 5. San Francisco, Cal. 1936.
78. Feldhaus, F. M. *Zur Geschichte der Windbüchse. Zeitschrift für Historische Waffenkunde,* p. 271 (trans. E.G.W.). Dresden. 1905.
79. ..... *Das Luftgewehr als Kriegswaffe.* Same source (See 78), p. 368 (trans. E.G.W.).
80. Ffoulkes, Chas. J. Inventory and Survey of the Armouries of the Tower of London. P. 406, item 715. London. 1915.
81. Fidd, Tony. Current collection. Rochester, N. Y.
82. Ford, Paul Leicester. The Many-sided Franklin. P. 432. Century Co., New York. 1898, 1899, 1926.
83. Foster, Albert. New York. Personal communication, 1947 (?).
84. Franklin Institute. Journal, Vol. 18. Philadelphia. 1834.
85. Freytag, Gustav. Pictures of German Life (trans. by Mrs. Malcolm). Vol. 1, Chap. III, The Citizen and His Shooting Festivals, 1300–1800. p. 134 *et seq.* London. 1863.
86. Furness, William Henry. The Home-Life of the Borneo Head-Hunters, etc. Lippincott, Philadelphia. 1902.
87. Gardner, Robert Edward. Arms Fabricators Ancient and Modern. Columbus, Ohio. 1948. Also: Five Centuries of Gunsmiths, Swordsmiths, and Armourers (Alphabetized). Columbus, Ohio. 1948. (These amount to two editions of the same work.)

88. Gedney, George W. B. U. S. Patent, Sept. 24, 1861, No. 33344.
89. George, J. N. English Pistols and Revolvers. Small-Arms Technical Publishing Co., Onslow Co., N. C. 1938.
90. ..... English Guns and Rifles. Small-Arms Technical Publishing Co., Plantersville, S. C. 1947.
91. Giffard, Paul. Giffard's New Gun, with liquefied gas . . . Maison Quantin, 7, Rue Saint-Benoit, Paris. 1889.
92. ..... British Patent, Oct. 30, 1862, No. 2931.
93. ..... U. S. Patent, Feb. 9, 1864, No. 41500.
94. ..... U. S. Patent, Feb. 25, 1873, No. 136315.
95. ..... U. S. Patent, Feb. 25, 1873, No. 136316.
96. ..... British Patent, Jan. 3, 1872, No. 21.
97. Gladwin, Harold Sterling. Men Out of Asia. P. 319. New York. 1947.
98. Glaser, W. *Waffen-Munition Katalog*. P. 48, no. 376 (trans. E.G.W.). Zurich, Switzerland. c. 1932.
99. Godfrey, P. C. Scientific American (advertisement). July 16, 1870, repeated through Aug. 6. P. 46.
100. Goessl, E. A. Assistant Curator of History, Milwaukee Public Museum, Milwaukee, Wis. Personal communication, June 6, 1951.
101. Grancsay, Dr. Steven V. Curator of Arms and Armor, Metropolitan Museum of Art, New York. Personal communication, 1948 (?).
102. Greener, W. W. The Gun and its Development. 9th ed. London. 1910.
103. Gun Collectors Letter. Issues 1–17, pp. 1–104. Madison, Wis.
104. Gun Collector. Issues 18—(continuous pagination). Madison, Wis.
105. Gun Report, Aledo, Ill. The Miracle Gun. G. Charter Harrison, Jr. Oct., 1956.
106. ..... Haviland and Gunn to Quackenbush. G. Charter Harrison, Jr. Sept., 1957.
107. ..... The Saloon Gun. G. Charter Harrison, Jr. Dec., 1957.
108. ..... The Lewis and Clark Air Gun. G. Charter Harrison, Jr. May, 1956.
109. ..... More on the Lewis and Clark Air Gun. G. Charter Harrison, Jr. June, 1956.
110. ..... Re-inquiry into the Lewis and Clark Air Gun. G. Charter Harrison, Jr. Nov., 1957.
111. Gunn, George Peck. U. S. Patent, March 9, 1886, No. 337395.
112. ..... U. S. Patent, Oct. 4, 1887, No. 370817.
113. Haines, Rev. Herbert. A Manual of Monumental Brasses . . . Vol. 1. J. H. & Jas. Parker, Oxford and London. 1861.
114. Hallam, Lt. Col. Robert M. Anderson, Ind. Personal communication, 1950 (?).
115. Hall, John and Thornton, William. U. S. Patent, May 21, 1811 (no number).
116. Hannah, William W. U. S. Patent, June 11, 1872, No. 127873.
117. Haviland, Benjamin and Gunn, George P. U. S. Patent, April 18, 1871, No. 113766.
118. ..... U. S. Patent, May 21, 1872, No. 126954.

119. Hawley, E. H. U. S. Patent, June 1, 1869, No. 90749.
120. Hime, Lt. Col. Henry W. L. The Origin of Artillery. Longmans, Green & Co., London. 1915.
121. Hoff, Arne. Dated XVII Century Air-Guns. The Gun Collector, No. 36, p. 574
122. ..... The Rasmussen Revolving Guns. *Tøjhusmuseets Skrifter 4,* Copenhagen. 1946.
123. Hofmann, E. H. Paudex-Lutry, Switzerland. Personal communication, June 18, 1949.
124. Hollander, Charles. New York. Personal communication, 1950 (?).
125. Hoopes, Dr. Thomas Temple. St. Louis, Mo. The Double Set Trigger (in A Miscellany of Arms and Armor). New York. 1928.
126. ..... Personal communication, May 23, 1946.
127. ..... Personal communication, Oct. 7, 1946.
128. Hopkins, Edward J. The Organ. London. 1877.
129. Horner, Frank. Current collection. Madison, Wis.
130. House, Charles. Milwaukee, Wis. Personal communication, 1948 (?).
131. International Encyclopedia, The New. 2d ed.: Air Gun. Dodd, Mead & Co., New York. 1928.
132. Jackson, Sir Charles James. English Goldsmiths and their Marks. P. 416. MacMillan & Co., London. 1921.
133. Jackson, Herbert J. European Hand Firearms of the 16th, 17th, and 18th Centuries . . . Pl. 55, fig. 95. Chiswick Press, London. 1923.
134. Janke, Paul C. Houston, Texas. Personal communication, 1950 (?).
135. Johnson, Iver and Bye, Martin. U. S. Patents, April 11, 1876, Nos. 176003 and 176004.
136. Johnston, J. H. Great Western Gun Works Catalog. Pittsburgh, Pa. 1873.
137. ..... Great Western Gun Works Catalog. Pittsburgh, Pa. 1884.
138. Kahrl, F. Wm. Mt. Vernon, Ohio. Personal communication, 1950 (?).
139. Kimball Arms Co. Woburn, Mass. Arms Catalog, 20th ed.
140. Kimball, G. C. Woburn, Mass. Personal communication, Oct. 11, 1952.
141. Kimbrough, Robert E. Japanese Firearms. The Gun Collector, No. 33, p. 457. Sept., 1950.
142. Klavestad, Osborne. Minneapolis, Minn. Personal communication, Jan. 21, 1947.
143. Knight, Charles. The English Cyclopedia; Arts and Sciences (or Fourth Division). Vol. 1, "Air Gun." London. 1866.
144. Knight, Edward H. Knight's American Mechanical Dictionary. 1876.
145. Koelle, Gertrude S. Librarian, Camden Free Public Library, Camden, N. J. Personal communication, 1947 (?).
146. Kukatchka, Dr. B. F. Forest Products Laboratory, Madison, Wis. Personal communication, Nov., 1949.
147. Kunitomo, Fujihyoe. *Kihō-Ki* (trans. A.J.G.). Gōshū, Ōmi, Japan. 1819.
148. Laking, Guy Francis. The Armoury of Windsor Castle. Pp. 100, 132. London. 1904.
149. Lammers, Norman K. Madison, Wis. Personal communication through J. T. Teesdale, Jan. 22, 1946.

150. Lane, Kenneth. Lausanne, Switzerland. Adv. in The Gun Report, May, 1956, p. 28.
151. Leavitt, Daniel. U. S. Patent, April 29, 1837, No. 6669.
152. Lederer, Bruno. New York. Personal communication, Dec., 1952.
153. Lewis and Clark Expedition, Original Journals of the, 1804–1806. Ed. by Reuben Gold Thwaites. New York. 1904.
154. Lewis, Capt. Meriwether. The Journal of. Ed. by Milo M. Quaife. Wisconsin State Historical Society, p. 31. Madison. 1916.
155. Lindner, E. U. S. Patent, Dec. 16, 1862, No. 37173.
156. Linné, S. Modern Blowguns in Oaxaca, Mexico. Ethnos, Nos. 3–4, pp. 111–119. 1948.
157. Linton, Ralph. The Tanala, a Hill Tribe of Madagascar. Field Museum of Natural History Publication 317, Anthropology Series, Vol. 22, pp. 243–247. Chicago.
158. ..... Personal communication, Aug. 9, 1951.
159. Lippincott. A Complete Pronouncing Gazetteer or Geographical Dictionary of the World. Ed. by A. Heilprin and L. Heilprin. Lippincott, Philadelphia and London. c. 1922.
160. Locke, William. Cincinnati, Ohio. Personal communication, Dec., 1944.
161. Lowe, J. C. St. Louis, Mo. Personal communication, 1948 (?).
162. Mack, David J. Current collection. Madison, Wis.
163. Maleyka, E. h. K. *Windbüchsen des 17 and 18 Jahrhunderts als Jagt- und Kriegswaffen, Blasrohre.* (Trans. E.G.W.) Berlin. 1937.
164. Mann, James G. Wallace Collection Catalogues, European Arms & Armour, etc. Part III, p. 205. London. 1945.
165. Maretsch, Otto. *Luftgewehre. Schuss und Waffe, No. 3.* Pp. 186–187 (trans. E.G.W.). 1910.
166. Markham, W. F. U. S. Patent, Oct. 25, 1887, No. 372161.
167. Marks, H. The Air Gun as a Serious Weapon. Fry's Magazine, 1906:5, pp. 184–189.
168. McCarthy, James Remington. A Matter of Time. Harper & Brothers, New York and London. 1947.
169. McLean, William A. U. S. Patent, Oct. 28, 1924, No. 1512993.
170. Memline. *Paul Fierens* (trans. H.L.W.) *Les Editions Braun & Cie., Paris.* 1935.
171. Merwin Sales Co., New York. Sales catalog, May 20, 1913. Item 54.
172. ..... Sales Catalog, June 11, 1914. Item 680.
173. ..... Sales Catalog, Jan. 21, 1915. Item 367.
174. Metschl, John. The Rudolph J. Nunnemacher Collection of Projectile Arms. Milwaukee Public Museum Bulletin 9. 1928.
175. Midland Gun Co., Birmingham, England. Sales list no. 2. 1924.
176. Morgan Library, Pierpont, New York. Manuscript 232.
177. Nicholson's British Encyclopedia or Dictionary of Arts and Sciences. 3rd American Edition: item, Pneumatics. Philadelphia. 1819.
178. Nock, Edgar L. Ramblewood, Wickford, R. I. Personal communication, March 9, 1945.

179. Park-Bernet Galleries, New York. Auction catalog, Flanagan Collection. April 21, 1944.
180. Patents for Inventions, Abridgements of Specifications; Class 119, Small Arms; Period—A.D. 1855–1865. Printed by His Majesty's Stationery Office, London. 1905.
181. Paul, William. Beecher, Ill. U. S. Patent, March 31, 1923, No. 1481526.
182. ..... U. S. Patent, Feb. 9, 1924, No. 1506995.
183. Payne-Gallwey, Sir Ralph. "Shooting." Badminton Library, London. 1892.
184. ..... The Crossbow. London. 1903.
185. Pettengill, Asia. U. S. Patent, May 28, 1878, No. 204167.
186. Pollard, Capt. Hugh B. C. The Book of the Pistol & Revolver. London. 1921.
187. ..... A History of Firearms. London. 1926.
188. Popular Mechanics. June, 1946, p. 260.
189. Powell, R. & Son. Gun goods catalog, August, 1875. Cincinnati, Ohio.
190. Quackenbush, Henry Marcus. U. S. Patent, Oct. 22, 1867, No. 70016.
191. ..... U. S. Patent, June 6, 1871, No. 115638.
192. ..... U. S. Patent, Nov. 17, 1874, No. 156890.
193. ..... U. S. Patent, March 7, 1876, No. 6977 (Reissue).
194. ..... U. S. Patent, Oct. 4, 1887, No. 370817.
195. ..... U. S. Patent, July 22, 1884, No. 302283.
196. ..... U. S. Patent, March 6, 1877, No. 188028.
197. ..... U. S. Patent, June 6, 1876, No. 178327.
198. Quackenbush, Paul. Herkimer, N. Y. Personal communication, 1948 (?).
199. Reichenberger, Max. Current collection. Milwaukee, Wis.
200. Reilly, Edward Michael, Jr. Air Guns, Air Canes, and Air Weapons. No. 502 New Oxford St., London. (Copy from British Patent Office.) c. 1850.
201. Renwick, Major Wm. Boston, Mass. Personal communication, Sept. 12, 1946.
202. Retting, Martin. Sales list, June, 1939. West Hurley, N. Y.
203. Riling, Ray. Philadelphia, Pa. Personal communication, 1948 (?).
204. Ritter, Robbins H. Sales list, Sept. 1, 1949. E. Hartford, Conn.
205. Rodke, Fritz. *Zeitschrift für Historische Waffen-und Kostümkunde*. Vol. 8 (N.S.), No. 5/6, pp. 133–4 (trans. E.G.W.).
206. Rowell, Prof. L. D. Madison, Wis. Personal communication, Nov., 1949.
207. Ruel, A. G. Current collection. Madison, Wis.
208. Satterlee and Gluckman. American Gunmakers. Buffalo, N. Y. 1940.
209. Schön, J. *Geschichte der Handfeuerwaffen* (trans. E.G.W.). Dresden. 1858.
210. Scientific American. Vol. 25, No. 11 (Sept. 9, 1871), p. 174.
211. Scott & O'Shaughnessy, Inc. Auction catalog No. 47, Nov. 19, 1918. New York.
212. Scrivenor, J. B. Sakai Marksmanship with a Blow Pipe. Nature, Aug. 12, 1933, p. 243.
213. Sears, Roebuck & Co. Catalog, 1902, p. 298.

214. Serven, James E. Firearms and Accessories Catalog. Featuring the Charles D. Cook Collection, p. 45, item 807. Foundation Press, Santa Ana, Cal. 1952.
215. Sheridan Hand Book. Sheridan Products Inc., Racine, Wis., p. 10. 1946.
216. Shue, Earl V. U. S. Patent, June 30, 1914, No. 1102204.
217. Smith, Sam E. Markesan, Wis. Personal communications (numerous, undated).
218. Sporting Goods Gazette. Oct., 1890, p. 16.
219. ..... Advertisement (issue not determined), 1889.
220. ..... April, 1890, p. 14.
221. Stanley, Merritt F. U. S. Patent, Jan. 28, 1890, No. 420316.
222. Stich, Thomas. Current collection. Milwaukee, Wis.
223. Stirling, M. W. Historical and Ethnographical Materials on the Jivaro Indians. Bureau of American Ethnology, Bull. 117, pp. 80 85. Washington. 1938.
224. Støckel, Johan F. *Haandskydevaabens Bedømmelse,* (trans. G.C.H.). Copenhagen. 1938.
225. Strabo, The Geography of. (Translated by H. C. Hamilton and W. Falconer.) Vol. 1, p. 465. London. 1854.
226. Strom, Hans. *Wörterbuch für die Waffen-Munitions-und Sprengstoff-Industrie unter Einschluss des Kriegsbedarfes.* (Trans. E.G.W.) Suhl. 1933.
227. Thevin, Fernand. *Un Fusil á Vent; Armes á Feu et Armes Blanches,* Pp. 147, 148 (trans. H.L.W.). Paris, 1914.
228. Thierbach, M. *Die Geschichtliche Entwickelung der Handfeuerwaffen.* (Trans. E.G.W.) Dresden. 1899.
229. Townsley, Major Ernest E. Silence is Golden? American Rifleman, July, 1929.
230. Trow's New York Directory. (Dates as noted in text.)
231. United States Cartridge Company's Catalog. Lowell, Mass. Undated, c. 1903–1906.
232. Van Rensselaer, Steven. American Firearms. Watkins Glen, N. Y. 1949.
233. Walker, G. A. U. S. Patent, July 18, 1876, No. 179984.
234. Walpole Galleries, New York. Auction sales catalog No. 232, June 5, 1922, item 28.
235. ..... Catalog No. 267, Feb. 14, 1923, item 424.
236. ..... Catalog No. 321, April 11, 1924, item 297.
237. ..... Catalog No. 273, March 27, 1923, item 237.
238. ..... Catalog No. 206, Dec. 13, 1921, item 127.
239. Wandrus, Harry. Current collection. Chevy Chase, Md.
240. Ward-Price Ltd. Auction Catalogue of Charles Noe Daly Collection, Toronto, Canada, June 5, 1935, item 162.
241. Watkins, Clayton. Advertisement in American Rifleman. December, 1946.
242. Webster's New International Dictionary. Springfield, Mass. 1917.
243. Weisz, C. H. Arlington, Va. Sales list, Aug., 1951.
244. Wesley, L. London, England. Personal communication, Oct. 9, 1948.

245. ..... Personal communication, Sept. 8, 1949.
246. ..... Personal communication, Jan. 16, 1950.
247. ..... Sales list No. 24, May 30, 1949.
248. ..... Sales list No. 29.
249. ..... Personal communication, June 18, 1949.
250. White, James. Highland Park, Ill. Personal communication, Nov. 18, 1949.
251. ..... Sales list R.
252. Wolff, Eldon G. Something on Air Guns. Milwaukee Public Museum, Museum Record, Vol. 4:1, p. 5. July, 1947.
253. Ye Olde Curiosity Shop, Catalog of. P. 26, no. 1131. Philadelphia, Pa. Undated, c. 1925.

Index

NOTE:

No references are included from the preface.

Makers' names are included in this index only if they occur in the text. For an alphabetized listing see Appendix III, p. 153.

Direct sources are not listed, only indirect sources.

A topical listing is here included, along with specific wording, as advisable in specific instances.

	Page
Accident	132
Acier	125
Adjustable trigger	20
Advantages (of air gun)	25, 28
Agricola	10
Allger	128
Ambush	25
Ammunition available	29
Anacharsis	3
Apache	17, 24, 137
Archimedes	33
Arco	9
Arquebus	9
Assassin	24, 26, 27
Austria	22
Austrian air rifle (1780)	27
Austrian marksman	29
Baillie-Grohman	21
Ballistics	39
Ballou	22, 132
Bandle	66
Barbs	116
Barnes	118
Barrels, interchangeable	116
Barrel liners	50
Basler	70
Basler & Denk	66
Bate	5, 103, 108, 109, 110
Baton	133, 134
Bayer	59
BB gun	76
Bedford	74, 75
Bellows	3, 10, 11, 12, 131
Bellows elements	55
Bellows gun	18
Benjamin	132, 137
Berlin bottom-ball	105, 109, 112
Besch	88
Bischoff	128
Blanch	118
Blickensdoerfer	65, 66
Blickensdorfer & Schilling	67
Blow gun	3, 33
Blow gun construction	37
Blow gun migrations	38
Bombard	33
Borneo	34
Boslar	89, 91
Boston, Mass.	56
Bouillet (Jean & Nic.)	4, 5, 133, 134
Bouron	130, 132
Bow	33
Braccio	41
Brecht	67
Breech loader	49
Breech mechanism	49
Breech, revolving	117
Breitenstein	67
Büchsen	7, 9
Bügelspanner	79
Bugio	9
Bunge	63, 64
Bunney	110
Buso	9
Bye	74
Cantriner (See Contriner)	96
Carbon dioxide (See CO_2)	123
Cartridges	116
Cellini	14, 39
Certainty of ignition	32
Challenge	78
Challenger	137
Chamber pressure	49
Chapel	118
Cheek pieces	59
Cherokee	36
Chicago	78, 79
Chronicon Nurembergense	7
Civil War	18, 56
Cleaning	28
CO_2	123, 127, 134
Cogswell & Harrison	118
Coirier	77
Colbe	102, 108
Colnot	96
Colt	28, 64
Columbia	78
Compressor	14
Construction (reservoir)	94, 95
Continental Army	22
Contriner	4, 93, 98
Conway	113, 114
Cook	118
Cookson	48, 53, 109
Cooling in discharge	30
Cost (of construction)	30, 32, 50
Counting device	18
Craftsmanship	53
Crank	47
Crewfe	97
Cromwell	24, 80, 108
Crosman	17, 23, 123, 132, 133, 134, 137

	Page
Crossbow	33, 49, 59
Crossbow maker	53
Crossbowman's plant	43
Crossbowmen	7
Ctesiphus	5, 13
Curly wood stock	101
Daisy	75, 78, 79
Darts	35, 43
Dating	53
Davaston	133
Davidson	110
Demon Gun Works	118
Dick	70
Disadvantages of firearms	25
Dolleczek	27, 97
Donyland Park	31
Doppelmayr	10
Dry ice	123
Dürer	10, 11
Dynamite gun	16
Effectiveness	19, 20, 28, 42
Efficiency	19, 50
Egg	109, 111
Eggers	63, 70
Elliott	73
Emplacement	29
Engel	69
Ethics	27
Eureka	74, 75
Fachter	4
Facka Speyer	5
Fecht	102, 103
Fehr	101
Fire lighters	82
Fischer	4, 106
Fisher	58, 59
Flash in the pan	29
Flash-over	27, 28
Fletcher	118, 119
Flint & air gun	89
Flint-lock	25, 32, 90, 102
Flint-lock repeater	28
Flint-lock rifle, mod. 1819	22
Fouling	27, 28
France (laws)	23
Franklin	29, 132
Frey	83, 87, 88
Friederich	72
Frontier weapon	32
Fruwirth	93, 97, 98
Fusee links	48
Futter	4
F Z	51
Gallery elements	55
Gartner	65, 67
Gasquoine	120
Gemmer	70
Geneva, N.Y.	56
Gerlach	4, 101, 103
Giffard	123
Girardoni	23, 27, 30, 92, 93, 96, 97, 98, 99
Globe	78
Goat's-foot lever	66
Gottsche	5
Grancsay	13
Great Western Gun Works	65, 67, 73
Grebles	67
Greener	120
Greyer	59
Guericke, Von (See Von Guericke)	
Gunn	76
Gunpowder (in reservoir)	15, 16
Guter	4, 6, 7, 9
Haas	89, 91
Hackenbüchse	9
Hall	49
Hand cannon	7
Hand organ	11, 12
Hanson	113, 114
Harpoon	116
Harquebus	9
Harquebusier	8
Harrold	120
Hartwich	88
Haviland & Gunn	74, 75, 76
Hawley	131
Heat of discharge	30
Heberlein	67
Heiberger	98
Henry IV	6, 13, 14
Heriot	110
Herkimer, N.Y.	72
Highest Possible	136, 137
Hill	83, 86
Hintz	51
Hohli	98
Horn Valve	30
Houghton	106, 107
Hunting	18, 19, 21, 22, 37, 42, 43, 45
Hurricane	75
I. Bang Hoang	98
Identification (legal)	24
Ignition, certainty of	32
Ilion, N.Y.	76
Indonesia	12
Interchangeable barrels	116
Italian gun	96
Ivan in Polin	98
Japan	80
Jivaro	37
Jivaro blow gun with accessories	36
Johnson, Iver	22, 74
Johnston	65, 67, 68
Jover Son & Bate	110, 111
Kalamazoo	130, 131
Kelk	103, 104
Kentucky rifle	19, 20, 101, 107, 129, 130
Kerr	120
Key	47
King	76
Kolbe	54, 102, 108, 111
Kuchenreiter	51
Kugler	70
Kuhlmann	89, 91
Kunitomo	80, 81, 83, 85, 87, 88
Kunz	121, 129, 130
Lachermeir	51
Lancaster	113
Laws	23, 24

	Page
Leavett	28
Leonardo da Vinci	3, 33, 39
Lewis & Clark	22, 33, 121, 131
Liebig	61, 62
Liege lock	82
Lightning	77
Lindner	58, 70
Liner	116
Linzel	65, 68
Load-compression	15
Lobsinger	4, 9, 10
London Armoury	120, 121
Lorenzoni	134
Lowentz	94, 98
Lückerschloss	82
Lukens	129, 130
Lunsmann	70
Lurch	57, 58, 60
MacGlashan	136
Machine gun	136
Machine gunner	29
Madagascar	35
Magdeburg hemispheres	14
Main spring, outside	104
Marin le Bourgeois (of Lisieux)	4, 6, 13, 14, 80, 81
Maringer	51
Marion & Sanner	72
Markham	79
Martin	14, 111
Matchless	78
Matchlock	7, 8, 9, 25
Maximum range	42
Medieval blow gun	33
Memling	11
Midland Gun Co.	121
Military	22
Miller	64
Miracle gun	127
Mock	58, 60
Molds	42
Molo	70
Mond	12, 48, 50, 51, 52
Moon	71
Mortier	26
Mortimer	113
Mouchin	89, 90, 92
Mulacz	52, 99
Mule-ear lock	105
Müller	5, 94
Munck	71
Munich	51
Musket	8
Musketeer	9
Musschenbroek	6
Muzzle-loaders	28
Napoleon	22, 23, 111
Neubecker	88
New Bedford, Mass.	56
Noise	26
Noiseless powder	26
Nuremberg air cannon	15
Nuremberg Chronicle	7
Oberlander	53
Octagonal barrel	101
Oesterleins	93, 98
Off-hand shooting	7, 8
Organ	11
Oriental (air guns)	23
Oriental countries	98
Original	71
Original Will	71
Orinoco R.	35
Outside-lock	17, 90
Outside main spring	104
Pary	88
Pau	14
Paul	136
Peep sight	50
Pelaix	22
Pell	52
Peloux	22
Penetration	20, 36
Perch-belly	59
Pettengill	76
Philadelphia, Pa.	129
Pill-lock	64
Pirko	52, 99
Pneumatic guns	17
Pneumatic telegraph	124
Poacher	22, 27, 31
Poe	14
Poison	35, 36, 38, 43
Pope	74
Porta, I. B.	10
Potsdam magazine	103, 104
Powell	67, 68
Prague	51
Pressure	20
Pressure retention	31
Prohibition (of air guns)	23
Proof mark	95
Pump	18, 89, 100, 128
Pumping machine	32
Quackenbush	18, 50, 54
Quackenbush models	76
Range	42, 46
Rapid fire	27, 28
Raquet	71
Rasch	88
Rasmussen	123
Rate of fire	30
Rauh	62
Refrigerator	124
Refugee	111
Reilly	119, 121
Remington	28, 72, 75
Repeaters	17
Repeating mechanism	27
Reservoirs available	29
Restrictions	24
Retention of pressure	31
Revolution, American	22
Revolving breech	117
Revolving rifle	64
Richards	136, 137
Rieger	128
Rifling	96, 116
Rivault	13
Rochester	17
Rubber band	77, 135
Rutte	72

	Page
Saabedra	37
St. Louis	56, 78, 79
Saps (See Sars)	
Sars	4, 5, 17, 101, 102, 106
Schaetter	83, 87, 88
Scharf & Son	66
Schaz	51, 53
Scheiffel	80, 81, 83, 85, 88
Schembor	99
Schenk	83, 87, 88
Schilling	68
Schmaltztern	61
Schmetan	6
Schmettau	6
Schreiber	4
Screws	30
Sear mechanism	59
Secrecy	30
Set trigger	49
Sharp gun	18
Shaw	135
Sheridan	17, 24, 137
Shooting (at target)	7
Shooting festivals	7
Shot cartridges	116
Shotgun	29
Siegling	5
Sights	50
Silence of discharge	27
Silent bullet	23, 26
Sims-Dudley	16
Single shot	17
Slurbow	9
Smith	61, 62
Smoke (disadvantage of)	29
Social shooting	50
Soebenkees	10
Sound (of discharge)	26
Spanner	47
Spatzirer	49, 50, 51, 53
Spring gun	17
Spring, main, outside	104
Staudenmayer	54, 92, 94, 98, 99, 104, 108, 111, 112, 121, 122
Steam gun	33
Stein	65, 69
Steiner	62
Stephan	53
Stirda	99
Strabo	3
Syms	71
Syringe	10, 12, 18
Target practice	50
Target shooting	7
Thornton	21, 26
Thorsen & Cassady	78
Threads	30
Thurloe	24
Tonks	63, 70
Townsend	122
Tyssen	31
Uebel	71
Uniformity of effectiveness	28
Utrecht	24
Utting	111
Vacuum	14
Valturius	7
Valves	30, 86, 90, 95, 100
Valve-fitting problems	31
Valve seat	30
Variation in powder effectiveness	29
Vesuvius	17
Vetterli	96
Vienna	51
Volkmann	53
Von Fleming	24
Von Guericke	14, 15, 16, 80
Vrel	5
Wagstaff	24
Walker	74
Weisbrod	55
Wentzlav	89, 90, 92
Werner	5, 64, 107
Westley Richards	136, 137
Wheel lock	25, 32, 46, 47, 49, 53, 59
Wilkinson	109, 111
Wilson	122
Winchester	96
Windbüchse	4
Windgun	18, 19, 24, 108
Wirsing & Schemann	62
Wistaller	52, 53
Wolf	93, 99
Zalinski	16
Zelner	51, 53
Zimmer	98, 99
Zuendorff	61, 62

SCIENTIFIC PUBLICATIONS OF THE MILWAUKEE PUBLIC MUSEUM

The following publications of the Museum are sent in exchange for the publications of the museums and other scientific institutions and societies with which such relations have been established, or may be purchased at the listed prices.

Vol.	No.	TITLE	
I	1	Catalogue of the Odonata of North America, R. J. Muttkowski, 1910	Out of Print
I	2	Lolo Objects in the Public Museum, Milwaukee, Frederick Starr, 12 pp., 8 pl., 1911	$ .25
I	3	Bees of Northern Wisconsin, S. Graenicher, 30 pp., 1911	.25
I	4	Dream Dance of the Chippewa and Menominee Indians of Northern Wisconsin, S. A. Barrett, 156 pp., 17 pl., 1911	1.25
II	1	Washo Indians, S. A. Barrett, 52 pp., 13 pl., 22 fig., 1 map, 1917	.50
II	2	Decorative Art & Basketry of the Cherokee, Frank G. Speck, 34 pp., 9 pl., 1920	Out of Print
II	3	Notes on Mahikan Ethnology, Alanson Skinner, 30 pp., 5 pl., 1925	.40
II	4	Miwok Material Culture, S. A. Barrett and E. W. Gifford, 260 pp., 49 pl., 65 fig., 2 maps, 1933	Out of Print
III	1	Kratz Creek Mound Group, S. A. Barrett and E. W. Hawkes, 138 pp., 19 pl., 19 fig., 1919	1.00
III	2	Grand River Mound Group and Camp Site, John A. Jeske, 74 pp., 13 pl., 17 fig., 1927	1.00
III	3	Neale & McClaughry Mound Groups, W. C. McKern, 202 pp., 23 pl., 31 fig., 3 maps, 1928	1.75
III	4	Kletzien & Nitschke Mound Groups, W. C. McKern, 156 pp., 24 pl., 20 fig., 2 maps, 1930	1.50
IV	1	Ethnobotany of Menomini Indians, H. H. Smith, 174 pp., 36 pl., 1923.	Out of Print
IV	2	Ethnobotany of Meskwaki Indians, H. H. Smith, 152 pp., 9 pl., 1928.	Out of Print
IV	3	Ethnobotany of Ojibwe Indians, H. H. Smith, 199 pp., 32 pl., 1932.	Out of Print
V	1	Observations on Ethnology of Sauk Indians, A. Skinner, 57 pp., 1 pl., 1923	.80
V	2	Observations on Ethnology of Sauk Indians, Pt. 2, War Customs, A. Skinner, 60 pp., 11 pl., 1925	.80
V	3	Observations on the Ethnology of Sauk Indians, Pt. 3, Material Culture, A. Skinner, 62 pp., 14 pl., 1925	.90
V	4	Ethnology of Ioway Indians, A. Skinner, 174 pp., 29 pl., 2 fig., 1926.	1.50
VI	1	Mascoutens or Prairie Potawatomi Indians, Pt. 1, Social Life & Ceremonies, A. Skinner, 262 pp., 8 pl., 2 fig., 1924	Out of Print
VI	2	Mascoutens or Prairie Potawatomi Indians, Pt. 2, Notes on Material Culture, A. Skinner, 64 pp., 13 pl., 1926	.75
VI	3	Mascoutens or Prairie Potawatomi Indians, Pt. 3, Mythology & Folklore, A. Skinner, 85 pp., 1927	.75
VII	1	Ethnobotany of Forest Potawatomi Indians, H. H. Smith, 230 pp., 38 pl., 1 fspce., 1933	Out of Print
VII	2	Tamarack Bogs of Driftless Area of Wisconsin, H. P. Hansen, 74 pp., 6 pl., 3 fig., 27 maps, 1933	.75
VII	3	An Ecological Comparison of Two Wisconsin Peat Bogs, Joseph W. Rhodes, 58 pp., 4 fig., 21 maps, 1933	.65
VIII	1	Amphibians & Reptiles of Wisconsin, T. E. B. Pope and W. E. Dickinson, 1928	Out of Print
VIII	2	Crane-Flies of Wisconsin, W. E. Dickinson, 128 pp., 3 pl., 169 fig., 1 map, 1 fspce., 1932	1.50
VIII	3	Mosquitoes of Wisconsin, W. E. Dickinson, 97 pp., 1 fscpe., 33 fig., 1944	1.25
VIII	4	Louse Flies of Wisconsin, Kenneth MacArthur, 74 pp., 1 fspce., 28 fig., 1948	1.50
IX		Rudolph J. Nunnemacher Collection of Projectile Arms, Pts., 1 & 2, John Metschl, 1928	Out of Print
X	1	Copper, Its Mining & Use by Aborigines in the Lake Superior Region, G. A. West, 1929	Out of Print
X	2	A Wisconsin Variant of the Hopewell Culture, W. C. McKern, 144 pp., 30 pl., 14 fig., 2 maps, 1931	2.75

X	3	Dental Pathology of the Prehistoric Indians of Wisconsin, A. K. Fisher, H. W. Kuhm and Geo. C. Adami, 46 pp., 10 pl., 3 fig., 1931	1.00
X	4	Exceptional Prehistoric Copper Implements, Geo. A. West, 26 pp., 3 pl., 1932	.50
X	5	Certain Mounds & Village Sites of Shawano & Oconto Counties, Wisconsin, S. A. Barrett and A. Skinner, 152 pp., 24 pl., 30 fig., 1932	1.50
XI	1	The Devonian of Wisconsin: Lamellibranchiata, E. R. Pohl, 100 pp., 14 pl., 5 fig., 1929	1.50
XII	1	Cambrian of Upper Mississippi Valley, Pt. 1, Trilobita: Dikelocephalinae & Osceolinea, E. O. Ulrich and C. E. Resser, 122 pp., 23 pl., 1930	2.00
XII	2	Part 2, Trilobita: Saukiinae, E. O. Ulrich & C. E. Resser, 184 pp., 22 pl., 1933	2.00
XII	3	Part 3, Graptolitoidea, Rudolph Ruedemann, 42 pp., 10 pl., 4 fig., 1933	.75
XIII		Ancient Aztalan, S. A. Barrett (complete in one pt.) 602 pp., 100 pl., 161 fig., 2 maps, 1933	7.00
XIV	1	Studies on the Flora of Wisconsin, Pt. 1, The Orchids: Orchidaceae, A. M. Fuller	Out of Print
XV		Pomo Myths, S. A. Barrett (Complete in one part) 608 pp., 1933	5.00
XVI	1	Excavation of Ross Mound Group No. 1, Philleo Nash, 46 pp., 9 pl., 1 map, 1933	.60
XVI	2	The Red Cedar River Variant of Wisconsin Hopewell Culture, L. R. Cooper, 62 pp., 10 pl., 4 fig., 2 maps, 1933	.75
XVI	3	Preliminary Report on Upper Mississippi Phase in Wisconsin, W. C. McKern, 177 pp., 52 pl., 2 fig., 2 maps, 1945	Out of Print
XVII		Tobacco, Pipes & Smoking Customs of the American Indians (Complete in 2 Pts.), Geo. A. West, 1934	Out of Print
XVIII		Ballard Rifles in Henry J. Nunnemacher Collection, E. G. Wolff, 77 pp., 27 pl., 1945	Out of Print
XIX	1	Oneida Indians of Wisconsin, Robert E. Ritzenthaler, 52 pp., 17 pl., 1950	1.00
XIX	2	Building a Chippewa Indian Birchbark Canoe, Robert E. Ritzenthaler, 47 pp., 33 pl., 1950	1.00
XIX	3	Potawatomi Indians of Wisconsin, Robert E. Ritzenthaler, 76 pp., 21 pl., 1953	1.25
XIX	4	Chippewa Preoccupation with Health, Robert E. Ritzenthaler, 84 pp., 13 pl., 1954	1.25
XX		Material Aspects of Pomo Culture, S. A. Barrett, 508 pp., 62 pl., 8 fig., 1952. Complete in two parts	7.00

NEW SCIENTIFIC SERIES

The Bulletin series has been discontinued as of January, 1954, and all volumes formerly listed as incomplete are now considered as complete.

This has been replaced by a departmental series in which each publication for each department will be numbered from 1 on.

Publications in Anthropology, No. 1, Native Money of Palau, Robert E. Ritzenthaler, 45 pp., 1 fig., 1954	1.00
Publications in Anthropology, No. 2, The Mexican Kickapoo Indians, Robert E. Ritzenthaler and Frederick A. Peterson, 91 pp., 45 pl., 1956	2.00
Publications in Anthropology, No. 3, The Effigy Mound Culture of Wisconsin, Chandler W. Rowe, 103 pp., 36 pl., 1956	2.25
Publications in Anthropology, No. 4, The Menomini Powwow, J. S. Slotkin, 162 pp., 19 pl., 1957	4.00
Publications in Botany, No. 1, A Bibliography of Wisconsin Vegetation, by H. C. Greene and J. T. Curtis, 84 pp., 1955	1.50
Publications in Botany, No. 2, Part 1, Hawthorns of Wisconsin, by Emil P. Kruschke, 124 pp., 1 fspce., 57 pl., 1955	2.50
Publications in Ornithology, No. 1, A Half Century of Change in Bird Populations of the Lower Chippewa River, Wisconsin, Irven O. Buss and Helmer M. Mattison, 319 pp., 1 map, 26 pl., 1955	5.00

YEARBOOKS

This series published from 1921 through 1930.

POPULAR SCIENCE HANDBOOK SERIES

Numbers 1 through 7. Full information on request.